

- XX. *On the Relationship between certain West African Insects, especially Ants, Lycaenidae and Homoptera.* By W. A. LAMBORN, M.R.C.S., L.R.C.P., F.E.S., Entomologist to the Agricultural Department of Southern Nigeria. With an Appendix containing Descriptions of New Species, etc., by G. T. BETHUNE-BAKER, Pres. Ent. Soc., W. L. DISTANT, HARRY ELTRINGHAM, D.Sc., M.A., Prof. E. B. POULTON, F.R.S., J. HARTLEY DURRANT, and Prof. R. NEWSTEAD, F.R.S.

[Read June 4th, 1913.]

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INTRODUCTORY NOTE by Prof. E. B. Poulton.

THE following memoir was written by the author at various times between September 1912 and April 1913. The work was done in the Hope Department, where the specimens, which had already been mounted and labelled, were compared with the records of original observations made in Southern Nigeria. If Mr. Lamborn had not been so greatly pressed he would have entirely completed the memoir, but there was so much to be done during his last visit home that he was not able to put the finishing touches to the paper or to verify his account by a second comparison between specimens and manuscript. I have now, however, been through the whole of it and verified all the data. All additions or comments of my own, except mere verbal alterations, will be found under separate headings with my initials, or within square brackets. Many of the latter passages are also signed by my initials.

From the dates which are freely quoted in the body of the memoir it will be seen that Mr. Lamborn made his observations between September 1911 and the end of July 1912, when he sailed for England. A few earlier observations on the same subject, already published, are referred to under the respective species.

The author's collecting ground—Oni Camp, 70 miles East of Lagos—is at a low elevation, never more than 50 ft. above sea-level. The bush has been cleared in the immediate neighbourhood, but around the camp, at the time when Mr. Lamborn collected, were large tracts of primitive forest, in which, unless otherwise stated, it may be assumed that the captures were made. All precise distances such as "1 mile E.," etc., refer to localities in the forest at various distances to the East of Oni Camp.

In the laborious and minute work of preparing Mr. Lamborn's material so that this paper could be written, I have to thank my assistants in the Hope Department, Mr. A. H. Hamm and Mr. Joseph Collins. The setting, printing and labelling has involved a very large amount of labour, and the almost complete accordance between Mr. Lamborn's notes and the specimens is evidence that a successful result has been obtained.

It may be assumed that the notes in Mr. Lamborn's manuscript are confirmed by the data he had written to accompany the specimens, except in the few cases in which a discrepancy is mentioned. A careful examination of the whole of the material in the Hope Department will well repay the naturalist who is interested in ants and the insects associated with them. The related forms are kept together and arranged in the order of the present memoir to which they supply the fullest illustration. (E. B. P.)

INTRODUCTION.

The observations herein recorded were made during the latter part of a three years' sojourn in Southern Nigeria in a bush camp at Oni, situated 70 miles E. of the town of Lagos and about 10 miles from the sea.

In the course of a study directed in the first place towards an elucidation of the life-history of West African Lycaenid butterflies it was found that, as has frequently been noted in other parts of the world, a very close relationship exists between their larvae and ants.

The relationship has in the majority of cases in West Africa been found to be one tending to the common good of both, the ants lavishing their blandishments on the smooth soft-skinned larvae, and in some instances very definitely extending hospitality and protection to them in return for much-prized secretions from certain special glands, evidently very similar to those described for the first time in 1867 by Guenée as existing in certain European Lycaenid larvae, and since found in many New World and Oriental species. The character of the gland in various Ethiopian larvae will be touched on when recording observations made on particular specimens. For the present it will suffice to mention that in most cases an orifice from which a fluid secretion will exude under appropriate stimuli has been found to exist on the dorsal aspect of the 11th segment, and that behind it and to the

outer side is a pair of protrusible tubercles which seem to exert a definite attractive influence on the ants.

In other cases a triple association has been found to exist between Lycaenid larvae, ants and Homoptera, in which the larvae, though treated as honoured guests by their ant hosts, repay them with the basest ingratitude by devouring their fellow-guests the Homoptera. In such instances as far as has been discovered the attraction exerted on the ants by the larvae is a much weaker one than in the preceding case, for though the accessory tubercles have been noted, no gland has as yet been seen nor have the ants been observed to concentrate their interest at the site at which the secreting structure is usually found, as in other larvae. Still further, some Lycaenid larvae are undoubtedly present as predaceous intruders on colonies of Homoptera fostered by ants and are of no benefit to them whatever though they are tolerated from necessity, because the ants are unable to put up a successful fight with an enemy protected by hairy fringes, by hard rough tubercles or a tough cuticle, though, as will be seen, they do not hesitate to avail themselves of a chance to commence an attack when a favourable opportunity presents itself.

Prof. Poulton suggested to me that in writing an account of the various species I should perhaps give the most vivid impression in my power if I transcribed the original notes written when the living insects were actually before me, with only such alterations as more recent knowledge has shown to be necessary. These notes were originally contained in letters written by me to Prof. Poulton and I have to thank him for the care with which he has preserved them so that they are now available for my present purpose, for the trouble involved in identifying some of my specimens and in getting others named by various authorities, so that on my return I found them labelled and ready for reference; but above all I wish to thank him for the constant stimulus and encouragement afforded by his interest in my work and for his ever ready help and guidance by which alone my results could have been obtained.

It is also my pleasant duty to thank Mr. G. T. Bethune-Baker, Pres. Ent. Soc., Prof. Poulton, Mr. H. Eltringham, Mr. W. L. Distant, Mr. J. Hartley Durrant, and Prof. R. Newstead, F.R.S., who have contributed valuable sections to the Appendix; and Prof. A. Forel, who has named the

ants. Mr. W. C. Crawley very kindly carried this latter material safely to Switzerland and back, by hand.

The whole of the material is in the Hope Department at Oxford, and as the numbers originally attached to the specimens have been printed on the labels all can be readily identified.

A.—LIST OF ANTS AND INSECTS ASSOCIATED WITH THEM (E. B. P.)

I have drawn up the following analysis of the associations recorded in this memoir. The list of ants, with the exception of those marked by an asterisk, is quoted from Prof. Forel's paper, *Fourmis de Nigérie*, in *Revue Zoologique Africaine*, Brussels, 1913, pp. 352, 353. The species marked by an asterisk were with one exception determined by Prof. Forel, although they do not appear in his paper. The exception is *Oecophylla smaragdina*, r. *longinoda*, kindly determined by Mr. G. Meade-Waldo in the British Museum. The sign † indicates that the insects associated with the ants were also associated with each other, although the nature of the association is far from uniform. It is to be understood that the great majority of the ant-associations are with the larvae or pupae of the species named.

The ants were determined by Prof. Forel quite independently of their associations, and when his names had been affixed, and the ants re-grouped according to the Lycaenid larvae, etc., they were tending, it was seen that the species and races were remarkably constant in their respective groups. The exceptions were the two species of *Pheidole*, once mixed in the same group (pp. 467–8) almost certainly the result of an accident in labelling after the specimens had been received from Switzerland—and the two races, *alligatrix* and *winkleri*, of *Cremastogaster buchneri*, once mixed according to Prof. Forel's determinations (p. 484), once mixed, not in this but in another group, according to Mr. W. C. Crawley and Mr. A. H. Hamm (p. 484). It must be remembered, however, that *winkleri* and *alligatrix* are often very difficult to separate, and Forel himself speaks of intermediate forms. If there has been no mistake, the two forms are sometimes to be found attending the same larva, and it is difficult to believe that the races are really distinct.

Mr. W. C. Crawley has very kindly come to Oxford on purpose to verify the ants in the various groups, and has carefully examined the whole of the material. The data are so numerous and complex, and mistakes, in spite of the utmost care, so probable, that Mr. Crawley's examination of the collection has been a great satisfaction to me.

*1. ODONTOMACHUS HAEMATODES, Linn. ♀

Associated with the Lycaenid *Lycaenesthes flavomaculata* (p. 483).

2. SIMA AETHIOPS, Sm. ♀.

Associated with *Coccidae* and probably with the larva, and pupa of the Aegeriid moth *Tinthia lambornella* (p. 493).

3. CREMASTOGASTER BUCHNERI, For., r. ALLIGATRIX,
For. ♀.

Associated with the following Lycaenids: *Epitola oniensis* (p. 457), *Deudorix (Hypokopelates) obscura* (p. 471), *Lycaenesthes flavomaculata* (p. 483), *Triclema lucretilis* (p. 485). With *Stictococcus sjöstedti* (p. 462), and other Coccids (p. 486). Attacking the Jassid *Nehela ornata* (p. 462).

4. CREMASTOGASTER BUCHNERI, For., r. CLARIVENTRIS,
Mayr. ♀.

Associated with the Lycaenid *Lycaenesthes alberta?* (p. 476).

5. CREMASTOGASTER BUCHNERI, For. r., WINKLERI,
For. ♀.

At first Prof. Forel was inclined to consider this form as a variety of *africana*, Mayr, another race of *buchneri*, but more extended study has led him to give it the position of a separate race.

Associated with the Lycaenids *Aslauga lamborni* † and the Coccid *Stictococcus sjöstedti* (p. 447); with *Lycaenesthes flavomaculata* (p. 483), *Triclema lucretilis* (p. 485).

6. CREMASTOGASTER BUCHNERI, For., r. LAURENTI,
For. ♀.

Associated with the Lycaenid *Aslauga vininga* † and the Coccids *Dactylopius longispinus* and *Lecanium punctuliferum*, var. *lamborni* (p. 446).

In addition to the above races, *Cremastogaster buchneri*, For., ? race, is described as associated with the following *Lycaenidae*:—probably *Epitola ceraunia* (p. 456), *E. carcina* (p. 456), *Argiolaus alcibiades* (p. 474), *A. julus* (p. 474).

7. PHEIDOLE ROTUNDATA, For., var. ♂.

This form appears in Prof. Forel's paper under the name *Pheidole punctulata*, Mayr., r. *impressifrons*, Wasm. Prof. Forel, however, informs me that the ant is, in his opinion, even closer to *P. rotundata*, For. r., *ilgii*, For., than it is to *P. punctulata*. He considers it to be intermediate between *punctulata* and *rotundata* but nearer to the latter. This is the principal "house-ant" of Oni, although it is also found in the open. Throughout the following paper it will be described as *P. rotundata*, var., the name attached to the specimens by Prof. Forel.

Associated with the following Lycaenids after they had been brought home, nearly always replacing ants of other species removed at time of capture: *Aslauga lamborni* † and *Stictococcus sjöstedti* (p. 447); with *Myrina subornata* (p. 472), *Hypolycaena philippus* (p. 474), *Lycaenesthes lachares* (p. 478), *L. flavomaculata* (p. 483), *Triclema lucretilis* (p. 485), *Catochrysops malathana* (p. 488), *Oboronia punctata* (p. 489).

Associated with the following Lycaenids in the forest and clearing: *Hypolycaena philippus* (p. 474), *Lycaenesthes lachares* (p. 478), *N. lyzanus* (p. 484), *Oboronia punctata* (p. 489); probably with the Pyralid moth *Obtusipalpalis saltusalis* (p. 492). With the Membracid *Leptocentrus altifrons* (p. 495).

Attacking and uncertain treatment of the Lycaenid *Megalopalpus zymna* (pp. 463–4). Carrying off eggs of *Charaxes ussheri* (p. 467). Devouring sugar and dead insects in the house (p. 491). Attacking and carrying off larvae and imagines of the smaller "red house-ant" *Monomorium pharaonis*, L. (p. 491).

8. PHEIDOLE AURIVILLII, Mayr., r. KASAIENSIS,
For., ♂.

Associated with the Lycaenid *Megalopalpus zymna* † the Jassid *Nehela ornata* and the Membracids *Gargara variegata*, *Anchon relatum*, *Beninia* sp., *Leptocentrus altifrons*, etc. (pp. 458–468); with *Hypolycaena nigra* (p. 473),

H. lebona (p. 473), probably *H. philippus* (p. 474), probably *Lycaenesthes silvanus* (p. 476), *L. larydas* (p. 477), *L. lachares* (p. 478), *Oboronia punctata* (p. 489). Probably with the Pyralid moth *Obtusipalpalis saltusalis* (p. 492). With the Coccid *Stictococcus sjöstedti* (p. 460). With the Membracid *Anchon decoratum* (p. 498).

*9. OECOPHYLLA SMARAGDINA, F., r. LONGINODA,
Latr., ♀.

Associated with the Coccid *Stictococcus sjöstedti* (p. 447, 453), the Lycaenid *Euliphyra mirifica* (p. 450), a Heterocerous larva (p. 451), *Aphidae* (p. 453), with the Noctuid *Eublemma ochrochroa* † and *Stictococcus* (p. 491).

Carrying off just hatched larvae of the Saturniid moth *Bunaea alcinöe* (p. 467).

*10. CAMPONOTUS MACULATUS, F., subsp. ? ♀

Associated with the Lycaenids *Myrina silenus* (p. 472), and *Hypolycaena philippus* (p. 474), the latter as an exception. With the Psyllid *Rhinopsylla lamborni* (p. 498).

CAMPONOTUS AKWAPIMENSIS, Mayr., var. POULTONI,
For., ♀.

The sign ♀ has been inadvertently printed instead of ♂ in Prof. Forel's paper (*l. c.* p. 353).

Associated with the following Lycaenids: *Lachnocnema bibulus* † and the Jassid *Ossana bicolor* (p. 470); with *Myrina silenus* (p. 472), *Hypolycaena philippus* (p. 474), *Lycaenesthes silvanus* (p. 476), *L. larydas* (p. 477), *Catochrysops malathana* (p. 488). In shelters with Membracids and Jassids (p. 465). With *Nehela ornata* (p. 465). With the Membracids *Leptocentrus altifrons* (p. 495, 497), and *Neoxiphistes lagosensis* (p. 497).

B.—LYCAENIDAE ASSOCIATED WITH ANTS:
INTRODUCTORY NOTE (E. B. P.)

The following 27 species of *Lycaenidae*, with the exception of the *Lycaenesthes* group, are arranged in the order of Aurivillius' "Rhopalocera Aethiopica" (1898). In *Lycaenesthes* and its allies I have followed Mr. Bethune-Baker's monograph (Trans. Ent. Soc., 1910, p. 1).

Mr. Bethune-Baker's description of new forms of

Lycaenidae, in the Appendix to the present memoir (p. 499), includes a species of *Aslauga* upon which no bionomic observations have been made by Mr. Lamborn. It was thought, however, that it would be convenient for an account of this novel and interesting form to appear beside that of allied species whose bionomic associations are here recorded.

Emergence of the sexes.—Mr. Lamborn's careful records throw much light upon the question of the relative order of the emergence of the sexes of butterflies, and, in the present paper, some of his facts are now made public. It will be observed that in most *Lycaenidae*, of which a sufficient number were bred from the same family, the females emerged on the average before the males—a result opposed to the usual experience in butterflies. In *Euliphyra mirifica*, however, 3 males emerged before any of the 5 females (p. 455–6). The other species, in which marked results were obtained, are *Epitola ceraunia*, 9 females, 6 males, and 1 male and 1 female together, emerging in that order, Feb. 22–23, 1912 (p. 456); *Hypolycaena nigra*, 5 females, 1 male and 1 female together, 2 females, all within 24 hours, Feb. 13–14, 1912 (p. 473); *Lycaenesthes lachares*, the groups tabulated on p. 481, where the early emergence of females is very clear; *L. flavomaculata*, 1 female, 2 males, Jan. 19–20, 1912 (p. 483).

The notes also show that emergence of certain species takes place at a particular time of the day, and indicate furthermore the interval between emergence from the pupa and the first flight. This period is seen to be very short in Lycaenid butterflies, contrasting in the most remarkable manner with the facts observed by Mr. Lamborn in the specially protected *Acraeinae*.

Relationship with ants.—The relationship with the ants will be found to be extremely varied, some species, such as *Lycaenesthes flavomaculata* (p. 483), being associated with various kinds of ants, others again being confined to a single species. The number of observations upon the replacement of the ants found attending the larvae in the wild state by the "house-ant" *Pheidole rotundata*, var., are of the highest interest.

It will be noted that the behaviour of certain ants towards certain Lycaenid larvae is marked by much uncertainty, e. g. in *Euliphyra* and *Megalopalpus* (pp. 453, 463–1).

A puzzling and difficult problem is presented by *Euliphyra*, shown by Mr. Eltringham's paper in the Appendix (p. 510) and by Mr. Lamborn's observations (pp. 452-3) to be effectively protected against ants and to be attacked by them under certain circumstances (p. 453), and yet thrusting its head and neck into the mouth of an ant in order to be fed (p. 452). In such cases the most helpful consideration is probably that suggested in conversation to the present writer by Prof. W. M. Wheeler, viz. that the ant community is so successful and affords so safe a retreat from the attacks of enemies, that ants are liable to be overwhelmed by the numbers of forms living under their protection. The uncertainty of their temper is probably one means by which this danger is prevented from becoming too great; for a species that seeks the shelter of the ants' nest is itself taking terrible risks.

The species of *Lycaenidae* observed by Mr. Lamborn belong to both subfamilies *Lipteninae* and *Lycaeninae*. The *Lipteninae*, which will be described first, are included in the genera *Aslauga*, *Euliphyra* and *Epitola*.

In this and all the following sections of the present paper, when there is no further specification, it is to be understood that the ants referred to belong to the worker minor caste.

I. LIPTENINAE.

1. *Aslauga vininga*, Hew.

A. marginata, Plötz, 1888, is evidently the female of this species (see p. 499).

The associated ant was *Cremastogaster buchneri* r. *laurenti*.

No. 695. The following note referring to this ♀ specimen was written March 24, 1912 :—

"The larva of this *Lycaenid* was carnivorous, its prey being Coccids such as are now sent. These insects occur in great numbers at the base of some leaves on the under-side, filling up the depressions between the main ribs and clustering also on the stem just below the insertion of the petioles. They are attended by ants which frequently construct shelters over them."

The larva was found in the forest $1\frac{1}{2}$ miles E. of Oni, Feb. 25; pupation, March 3; emergence, March 14.

The Coccids have been determined as *Dactylopius*

longispinus, Targ.-Tozz. (p. 523), and 12 ants were in attendance.

No. 699. A ♂ specimen is referred to in the following note dated March 24, 1912 :—

“The larva of this *Lycaenid* was carnivorous and ate tiny smooth hemispherical insects attached in colonies to the stems of various plants, especially kola. These insects are also attended by ants which cover them with shelters.” Parts of two shelters are in the collection and the material of which they are built is described on p. 524 by Prof. R. Newstead. The larva was found in the forest 1½ miles E., Feb. 25; pupation, March 2; emergence, March 17.

The food-insects referred to are Coccids—a new form—which has been named *Lecanium punctuliferum*, var. *lamborni*, Newstead (p. 523), and the 19 ants found ministering to them are the same as in No. 695, viz. *C. buchneri laurenti*.

2. *Aslauga lamborni*, Bethune-Baker, sp. n. (p. 499).

The associated ant was *Cremastogaster buchneri* r. *winkleri*. In the house, *Pheidole rotundata*, var., was attracted to the larva or to the Coccids.

No. 543. The larva from which this male specimen was bred, Nov. 22, 1911, was obtained in the forest 1½ miles E. on Nov. 1, and it pupated Nov. 3. [The specimen is the male type of the species.]

A note dated Nov. 27, 1911, referring to it, is as follows :—

“The stem of the plant, *Bridelia micrantha*, Baill. (*Euphorbiaceae*), on which the larva was found, bore a number of *Coccidae* [*Stictococcus sjöstedti*, Cockerell] which are almost invariably attended by ants. They often roof over a number of the Coccids with a thin covering composed of particles of bark and other vegetable débris so as to form a convex chamber which fits down on all sides round the enclosed insects. The chambers are about the size and shape of a half hazel-nut, and they are tenanted by ants as well as Coccids.”

“Dec. 4, 1911. I am disposed to think that in some cases *Lycaenidae* find food where these bodies have been; for some stems frequented by the butterflies look as if they had borne the Coccids. The *Stictococci* are usually surrounded by a multitude of ants, and I was interested to see that the ferocious ‘tree-drivers’ (*Oecophylla*) do not

eat them but seem, like other ants, to visit them for some food-material."

The note dated Nov. 27, 1911, continues, speaking of the larva of *A. lamborni* :—

"The larva, brown in colour and resting motionless on the stem, looked so very like one of these ant-constructed chambers that it had a narrow escape from injury, for I actually attacked it with scissors under a mistaken impression as to what it really was, my custom being invariably to explore these chambers. I did not actually discover what its food was, for it pupated almost immediately."

The Homoptera have been determined by Prof. Newstead as a species of Coccid—*Stictococcus sjöstedti*, Cockerell (p. 521), of which 4 were borne by a stem of *Bridelia* sent with the specimens. The stem also showed distinct marks where other Coccids had been fixed to it. Two *C. buchneri winkleri* accompanying the specimens, were probably collected with the Lycaenid larva on Nov. 1.

No. 591. One male labelled B and a female labelled A. The text of a note dated Jan. 13, 1912, relating to these specimens, is as follows :—

"I discovered yesterday, in the forest $1\frac{1}{2}$ miles E., two carnivorous larvae, the food of which is the little beady insects found in considerable numbers, immobile and firmly fixed to the young shoots of certain plants."

The Lycaenid larvae, when found Jan. 12, were resting on plant stems, 2 of which are in the collection, and they bear many Coccids identified by Prof. R. Newstead, F.R.S., as *Stictococcus sjöstedti*, Cockerell (p. 521). Twenty-four ants, *C. buchneri winkleri*, attending the Coccid food-insects near to the larvae, were sent, together with 77 others visiting the Coccids or elsewhere on the plant.

The larva of B ceased feeding and became motionless Jan. 17, and both larvae pupated Jan. 19; A emerged Feb. 3, B Feb. 4.

My note goes on : "The two larvae were attended by ants [since determined as *C. buchneri winkleri*], and on the same stem were five Coccids which yield a watery secretion much in demand by ants. The leaves on the stem were snipped off and it was then carefully transferred to a glass tube so that none of the insects were disturbed. On arrival home it was found that 3 only out of the 5 Coccids remained. The ants were taken away and the larvae transferred, at 5 p.m. Jan. 13, to a tube containing

a stem bearing 22 Coccids. In a short time tiny black ants (identified as *Pheidole rotundata*, var.), which abounded in the house, found their way into the tube, which was then closed with very fine gauze and put away on a shelf, out of reach, it was thought, of more ants. However, more of the same species found it during the night and being unable to get in collected in a little knot on the gauze.

"When the tube was inspected at 8 a.m. on the following day, 14 of the Coccids had disappeared—most of them entirely. The rings which had formed the basal portion of the scale of a few Coccids were, however, left by the caterpillars.

"Later in the day I actually watched with a lens one of the larvae eating a Coccid, and at 1 p.m. only 3 Coccids out of the 22 remained. The larvae passed frass abundantly. The ants took no part in eating the Coccids."

A note dated Jan. 15, 1912, is as follows:—

"At 5 p.m., Jan. 14, 1912, the 2 larvae were placed in separate boxes and all ants excluded for 24 hours. By 5 p.m. on the following day A had consumed 12 out of the 15 Coccids that I had placed at its disposal, and larva B had taken 16 out of 28, a few basal portions still remaining attached to the stems supplied to both larvae. I found that the larvae would eat these Coccids whatever the plant they happened to be attached to. The secretion of the Coccids was not sweet to the taste, but had an aromatic flavour rather suggestive of turpentine.

"These larvae presented the same general characteristics as those of *A. vininga*, being oblong on dorsal view with lateral surfaces sloping downwards and outwards. They had a hard tough toad-coloured skin covered with coarse rough tubercles, evidently protective in function, and it extended down as a fold on all sides in carapace fashion so as to protect the softer lateral and ventral surfaces. The lower margin of this fold bore a fringe of very fine hairs such as would efficiently prevent small insects from crawling in underneath. The segmentation characteristic of Lepidopterous larvae was shown only by the presence of spiracles, but rather more than halfway to the anal extremity was a deep transverse groove, the only region at which, owing to the leathery consistence of the cuticle, it was possible for flexion to take place. The cuticle was indeed so hard that a larva placed on its back was unable

to bend itself sufficiently to turn over unaided. Towards the hinder end of the body and just inside the spiracular line were two horny rounded eminences, one on each side of the mid-dorsal line. From these eminences pointed tubercles were from time to time thrust out, but no dorsal gland was detected. The tubercles appear to represent those of the *Lycaeninae*, in which group, however, they are more externally placed, being just to the outer side of and behind the spiracles of the 12th segment (see p. 488-9).

"The head was small in proportion to the size of the larva and there was a definite neck, of sufficient length to enable the head to be thrust forward or retracted in tortoise-like manner under the shelter of the carapace. The anus was protected in a similar manner. I have witnessed the protective value of the carapace in a larva of this type as described on p. 452."

No. 526. Male. The pupa of this was found in the forest $1\frac{1}{2}$ miles E., on a leaf of the plant *Culcasia scandens* on Oct. 22, 1911, near black ants of the genus *Cremastogaster*. Emergence, Nov. 5.

No. 658. Female. The larva found in the forest $1\frac{1}{2}$ miles E., on Jan. 26, 1912, fed up, in five days' time, on *Stictococci* which were attended by the same ants as No. 591, etc., viz. *C. buchneri winkleri*. It is especially noted of 24 of these ants that they were not only attending the *Coccidae*, but also running over the *Lycaenid* larva.

Pupation, Jan. 31; emergence, Feb. 14.

No. 688. Female. The larva, found in the forest $1\frac{1}{2}$ miles E., on Feb. 16, 1912, fed up on the same Coccids, and pupated on Feb. 21, emerging March 6.

No. 819. Female. The larva was found in the forest $1\frac{1}{2}$ miles E., on June 5, 1912, and having fed up on the Coccids, pupated on June 8, emerging June 24.

3. *Euliphyra mirifica*, Holland.

[A brief revision of the genus based on Mr. W. A. Lamborn's material will be found on pp. 504-8. Mr. Eltringham's account of the larva will be found on p. 509.]

The associated ant was *Oecophylla smaragdina* r. *longinoda*.

A preliminary note as to the presence of *Lycaenid* larvae and pupae in the nests of *Oecophylla* was communicated to the Entomological Society on March 20, 1912, by Prof. Poulton (Proceedings, pp. xxxii, xxxiii), and, on Nov. 6, I

was able to exhibit to the Society (*ibid.*, p. cvi) two larvae in spirit and two bred imagines with the corresponding pupa-cases. Seven butterflies in all were bred out. The larvae, which approximate to the type described in *Aslauga*, seem to be very near to that of *Liphyra brassolis*, Westw., described by Bingham in his "Fauna of British India," to which account my attention was drawn by Mr. A. H. Hamm, of the Hope Department. This larva is found in the East and in Australia in the nests of *Oecophylla smaragdina*. It is apparently present as an intruder, and the suggestion has been made that it feeds on the immature forms of ants. Though I have paid especial attention to this point I have not found such habits in *Euliphyra*. Furthermore, the pupa is not protected by the hard chitinous larval skin described in *Liphyra*, although the skin of *Euliphyra* is tough and heavy-looking and still partially encloses the posterior segments of 3 out of 8 pupae, viz. E, F and G (see p. 455-6).

The following notes, contained in a letter dated Feb. 10, 1912, refer to the larvae of *Euliphyra* :—

"In accordance with your request I commenced an investigation as to whether our form of *Oecophylla* does make use of its larva to weave together the leaves composing the nest. I opened up some nests a few weeks ago, but the ants were so deliberate in their movements that I had to defer the necessary watching till I could spare more time.

"On Feb. 6 I made a window into a nest, snipping out a square piece of leaf with scissors, and on looking in I saw a larva which I recognised at once, as it was similar to the one which I saw assailed by these ants, but successfully protected itself against attack by drawing down its hard carapace-like shield in limpet fashion, to the supporting surface. I tore the nest open and discovered more larvae and thereupon took ants and all in a tin box. I broke other nests open and found larvae in four more, bringing up the total of larvae secured to 19. They were not all of the same age in each nest.

"In one nest, not containing these larvae, I found a totally different caterpillar—rather hairy and evidently Heterocerous. The hairs were very stout and curved back over each segment, obviously as a protection. I did not discover what it ate, and it soon formed a cocoon of stout silk inside a web of finer material. Last night, however,

some creature, probably a rat, broke into the box and ate it, together with a fine *Charaxes* pupa.

"I think that the 19 larvae must be Lycaenid! I will not attempt to describe them in detail as I am sending some in spirit. They are protected by a hard, leathery skin. The head is remarkable. When the larva is at rest, and usually when it crawls, the head is completely hidden by a fold of skin which extends all round so as to form, with the leathery skin of the dorsum and sides, a kind of carapace. The head is sometimes thrust forward under the fore margin of this fold and one then sees quite a long neck gradually tapering up to a point terminated by fine jaws. [For this and other details of the larval structure see Plate XXVIII and Mr. Eltringham's account, pp. 509-12.] The larva, as it crawls, frequently swings this proboscis first to one side and then to the other as if in search of food. It took me 48 hours to find out the source of their food-supply; for they did not touch the leaves, and I did not see them attack ants or ant larvae, neither did they go near the dead insects which the ants had stored as food.

"By this time the ants had to some extent settled down in glass-fronted boxes and I saw large workers feeding smaller ones, the two standing opposite to each other, the smaller with head a little bent back. I fancy that the larger ants must have been disgorging food into the mouths of the smaller ones. Anyhow I actually saw a Lepidopterous larva thrust its little proboscis into the jaws of a large ant and keep it there while the ant made movements as if feeding it. Sometimes too, when a large ant was feeding a smaller one, the latter retired in favour of a caterpillar.

"The caterpillars were frequently near with extended proboscis when the ants were ministering to their own male and female larvae.

"The feeding does not seem to take place very often: I presume that the high nutritive value of the material provided makes it unnecessary."

"Feb. 10, 1912. The larvae in the nests of *Oecophylla* have neither dorsal gland nor tubercles. I have not discovered how they can benefit the ants."

"Feb. 18, 1912. I replaced yesterday in the nests of *Oecophylla smaragdina* the rest of the larvae originally found; for the ants were not doing well. All the winged forms and some ant larvae had been dead for some days

and the workers seemed sickly. I think it is noteworthy that the larvae had all been on one leaf since my last note and that this had not been eaten at all; also that, though the ant larvae were dead and had dropped down—the last one four days ago—yet the Lepidopterous larvae were all alive and had even grown a little. The ants certainly seem to feed them.

“I find that if a worker comes across water it drinks, and then proceeds to disgorge it for the benefit of any one of its thirsty fellows that it may meet, and I think the same thing happens in the case of food. *Oecophylla* attends *Aphidae* and is also very fond of the secretion of *Stictococcus sjöstedti*.”

“March 29, 1912. I have hitherto failed to breed the Lycaenid larvae which live in the nests of *Oecophylla*. They appear to be extremely slow-growing. I am still watching the larvae, but observation is attended with difficulty, because the ants desert if one interferes too much, and it is necessary to break open the nest each time one wishes to inspect the larvae. The head and neck of the larvae appear to be protected against attack, but the ants lose no opportunity of seizing other parts. I once saw a larva crawling with an ant fastened on to one of its claspers, the abdomen only of the ant being visible, as the rest of its body was under the lateral fold of skin. I have also seen a larva which protected itself by just settling down closely on the supporting surface, and when the ants retired it raised itself a little and crawled, but when they reappeared settled down again.”

[F. P. Dodd—in his paper in “Entomologist,” 1902, p. 184—describes a similar attack by *Oecophylla* and defence by the larva of *Liphyra brassolis*.]

“May 13, 1912. I continue to watch the larvae in the nests of *Oecophylla*. They have grown considerably, but I have not been able to find pupae as yet. One has to be careful not to disturb the ants very frequently or they desert the nest.”

“June 10, 1912. You will have been expecting news as to the larvae which live in the nests of *Oecophylla*. I have a pupa at last. I have examined the nests about every fortnight, but my interference has caused the ants to remove to a new home nearly every time, and, as the larvae have been obliged to wander till they found the nest, I presume that some have been lost. To this I attribute

the gradual dwindling in their numbers. I have found the larvae a little larger each time I have inspected them, and to-night I found a fresh pupa with the cuticle of the larva still adherent to its base.

"Presuming that these larvae are the same that I restored to ants' nests weeks ago—and I think they are—they have taken far longer to attain full growth than in my experience is usual with *Lycaenid* larvae.

"I have examined a great number of nests of *Oecophylla* without finding more of these or any other larvae, and I frequently looked into nests last year and during my first year on the West Coast, for the purpose of watching the ants, and I did not find larvae, so that I am not disposed to accept the statement that Lepidopterous larvae are very commonly found in the nests of these ants in this country. I am inclined to think that one would find a greater variety in the nests of the black tree-ants (*Cremastogaster buchneri*), for I have now frequently seen *Lycaenids* ovipositing on the bark of trees frequented by these ants, and more than once in the actual stream of ants going up and down the trunk. I have also frequently found *Lycaenid* pupae and pupacases in the immediate vicinity of their black carton nests (pp. 456-7).

"I really must try and look through some of these nests. The difficulty is that they are so hard that one would require a hammer and chisel to make any impression on them, and the ants are excessively numerous and bite savagely.

"By the way, the *Lycaenid* larvae were mostly in one large nest of *Oecophylla*, and I subsequently collected a few in little outlying dependencies of the same nest. Should the butterfly turn out to be one of the rarer species, surely it would be an argument against their common occurrence in nests, for, in such a position, the mortality should not be high."

"June 24, 1912. I am sending the first of the *Oecophylla* *Lycaenids*. Some of the other pupae do not look very healthy, but I am sure to get a few more imagines. I forget if I mentioned that I had found one small pale green *Lycaenid* larva of the same type as these others in a nest of *Oecophylla*. I have since found 3 other larvae of some kind, so small that I am not even able to pronounce whether they are Lepidopterous or not. They are pale green in colour, so that I am not confusing them with the larvae of

ants, but the ants look after them with an assiduity as great as if they were their own offspring. When I looked into the nest the ants picked them up and carried them away, and one ant carried one of these in addition to a larva of its own species. I have made no further discoveries as to how the Lycaenid larvae feed."

"June 29, 1912. More *Oecophylla* Lycaenids are sent and cuticles accompany some of the pupa-cases. One cuticle in particular shows remarkably well the length of the neck of the larva."

"Feb. 10, 1912. The Lepidopterous larvae are not always well treated by the ants. It so happened that I accidentally put some into a box in a crevice of which there was some scale naphthalene. Some died and the others which revived were put into an ants' nest in a half-stupefied condition. Such as happened to fall on their backs were immediately seized by the ants. I also found that a healthy larva placed on its back has difficulty in turning over, and is in this position liable to attack. In one instance I saw a larva with an ant gripping it by the neck on the ventral side.

"When the larva feeds, the fore part of the body is raised and the margins of the lateral folds of cuticle are bent round till they meet, thus protecting the soft ventral surface. The head comes out at the apex of the cone thus formed."

The dates of emergence, etc., in 1912 of the 3 males and 5 females (818 A—H) of *Euliphyra mirifica* are as follows. All except one are figured on Plate XXVII.

818 A (Plate XXVII, fig. 5). Male: emerged June 20, 1912, from a pupa found earlier in the same month. The precise pupa-case accompanies this specimen as in each of the others.

B. Male (fig. 6) emerged June 28, from a pupa found in an *Oecophylla* nest in the forest, near Oni Clearing, June 11. Accompanying it is a dead pupa found attached to a leaf in the same nest.

C. Male (fig. 7): emerged June 29, from a freshly formed pupa found under the same conditions as B, on June 10.

D. Female (fig. 8): emerged July 1. Resting larva found in ants' nest June 11, pupation June 12. (Pupa-case, fig. 8A.)

E. Female (fig. 11): emerged July 2. Larva found in ants' nest June 11, pupation June 14.

F. Female (fig. 10): data as in E, save that the larva, found June 11, was in the resting state. (Pupa-case, fig. 10 A.)

G. Female: data as in F, save that pupation occurred June 13.

H. Female (fig. 9): emerged July 7, from a pupa found in ants' nest June 20. A dead pupa was also found in the same nest.

4. *Epitola ceraunia*, Hew.

The associated ant was probably a race of *Cremastogaster buchneri*.

No. 671. No less than 17 pupae were found at one spot $1\frac{1}{2}$ miles E., on Feb. 17, 1912. There were no ants in attendance, but *C. buchneri* abounded in the vicinity and were to be found on the shrubs bearing the pupae.

The pupae are very like those of *E. hewitsoni*, Mab., and are fixed like the latter so that they stand on their tails. "All except one rested at an angle of 45° on their tails, and usually on the upper side of a leaf. One [N] was suspended head down under a leaf."

[All the pupae are labelled so as to bring them into relationship with the respective imagines, and all are attached to the upper surface of a leaf, except N and Q, fixed to the under surface, and C, to a stem.]

The dates of emergence are as follows: 2.15 p.m., Feb. 22, 7 females A—G; 3 p.m., Feb. 22, 1 female H; about 3 p.m., Feb. 22, 1 female I; 11 a.m., Feb. 23, 2 males J, K; about 11 a.m., Feb. 23, 4 males L—O; about 12 p.m., Feb. 23, 1 male P and 1 female Q. It is obvious that the individuals belonged to the same company of gregarious or semigregarious larvae. The relative order of emergence of the two sexes is interesting and unusual.

5. *Epitola carcina*, Hew.

The associated ant was a race of *Cremastogaster buchneri*.

No. 652. This male butterfly was bred out, 8 a.m., Feb. 8, 1912, from a pupa, and was flying about 9.30 a.m. My note of Feb. 10 records that the pupa was found Feb. 7 on a leaf within a foot of a huge nest of black ants in the forest $1\frac{1}{2}$ miles E. These ants were undoubtedly a race of *Cremastogaster buchneri*, but I omitted to collect specimens. An empty pupa-case of the same species was also found on a leaf near by.

6. *Epitola oniensis*, Bethune-Baker, sp. n. (p. 501).

The associated ant was *Cremastogaster buchneri* r. *alligatrix*.

No. 635, A, B. These 2 male butterflies were bred from pupae. Emergence of A, 9 a.m., Feb 4, as it was being carried home; B, flying by 10 a.m., Feb. 6. My note concerning them is as follows :—

“Feb. 5, 1912. The two pupae were found Feb. 4, in a dead curled-up leaf of the ivy-like *Culcasia scandens*, climbing up a Kola tree in the forest 1 mile E. In a fork of the tree, and two feet above the pupae was a large carton nest of black ants [*Crem. buchneri alligatrix*, of which 35 were sent] which were running about in all directions, some being actually on the leaf bearing the pupae, a fact which strongly suggests the existence of a special association between them and the Lycaenid.

“I noted these Lycaenid butterflies in the vicinity of the same tree last year as well as this, and have often looked for larvae without success. There seems to me to be a very strong probability that the larvae have some relationship with the ants, but I did not find it feasible to break open the nest because it was very large and hard, and the ants, which were extremely numerous, bite very fiercely.”

At a later date, Feb. 12, an empty pupa-case of the same species was found at the same place, also very close to the nest of ants.

Although the male of this species closely resembles that of *E. carcina*, their pupae are easily distinguished by the size and form of the dark markings on the dorsal surface.

II. LYCAENINAE: INTRODUCTORY NOTE.

Before describing the observations upon the separate species it is convenient to record a few general notes made upon the ant-attracting gland and paired accessory structures of the Lycaenine larva. The notes, dated Jan. 13, 1912, were drawn up after an experience of about five or six species :—

“The median dorsal opening of the gland on the 11th segment of the Lycaenine larva, has in some species well-defined anterior and posterior lips, and I have been able to induce a larva to extrude a droplet of fluid by tickling it

with a wisp of wool. In some species the 11th segment is widened anteriorly opposite the mouth of the gland, and in some the opening is placed on a specially pigmented area. It is, however, possible, by careful examination, to detect the opening when there is no special pigmentation to indicate the site. In one case a pellet of excrement which accidentally fell upon the back of a larva deprived of ants, became firmly glued to the gland-opening. The secretion of another larva, also deprived of ants, had in 24 hours dried so as to form a little white crust over the orifice. Again, in a larva that had died, mould was growing at the orifice in about 12 hours, although not elsewhere.

"The ants certainly get nothing from the two accessory tubercles, and are never even permitted to touch them [see pp. 488-9], so that the only explanation I can think of is that they produce scent which attracts to the neighbourhood of the gland. There can be no doubt about the conclusion that the tubercles of some *Lycaenid* larvae do actually attract ants and keep them in attendance."

We now proceed to the observations upon various species of *Lycaeninae*.

7. *Megalopalpus zymna*, D. & H.

The associated ant was *Pheidole aurivillii* r. *kasaiensis*. The larvae were sometimes attacked by *Ph. rotundata*, var. These latter, in the house, were apparently sometimes hostile, sometimes peaceful.

The larvae, as will be seen by the following notes, are carnivorous, and feed on a variety of Homoptera belonging to the families *Jassidae* and *Membracidae*, which are invariably ant-attended.

I have not found that the ants derive any benefit from the presence of this larva, or that they are of service to it. There is, on the contrary, some evidence to show that their attitude to it is distinctly one of hostility, in connexion with which it is noteworthy that the larva is not of the smooth, soft onisciform type, characteristic of the *Lycaeninae*, but it is protected by a hard skin studded with tubercles which are surmounted by coarse sparse hairs.

The larva is dark-brown, a tint approximating very closely to the colour of the débris out of which the ant-shelters are constructed, a strong contrast again to the colour of the *Lycaenine* vegetable feeders, of which the great

majority discovered were leaf-green. As with the vegetable-eating larvae, the food of *Megalopalpus* seems to range within certain limits, but though larvae have been found eating both Jassids and Membracids, a larva accustomed to take Jassids will refuse Membracids and *vice versa*, and there is some evidence that a larva which habitually eats one form of Membracid will refuse a closely-allied species.

The mother butterfly, in depositing her egg, which is a very characteristic one, exercises the same care in ensuring an immediate food-supply for the newly-hatched larva as do other butterflies for their plant-eating offspring. She places it very commonly in the immediate neighbourhood of an ant-shelter containing Homoptera, and an egg-shell is sometimes found attached to a stem actually within a shelter, having obviously been deposited before the Homoptera attracted the attention of ants. and, indeed, probably on the egg-mass itself, before hatching, since the Membracid and Jassid colonies seem to remain and feed close to the spot where the parent laid her eggs. The eggs of *Megalopalpus* have been found attached to the egg-mass of the Homoptera, and in two cases actually on living and half-grown Membracid nymphs (p. 466).

Not only does *Megalopalpus* feed in the larval state on the Homoptera, but the butterfly seems frequently to flourish also at their expense, probing them with its proboscis and obtaining food-material direct from their surface, as well as from the plant on which they happen to be resting. [It will be seen on pp. 467, 468, that this habit is as characteristic of males as females, and cannot therefore be interpreted as bearing relation to oviposition.]

The following material forms the subject of the succeeding notes, dated Jan. 18-22, 1912.

No. 603 A. ♂. Larva in forest $1\frac{1}{2}$ miles E., Jan. 14, 1912; pupation, 3-5 p.m., Jan. 20; emergence, 6.30 a.m., Feb. 1.

No. 603 B. ♀. Larva in forest $1\frac{1}{2}$ miles E., Jan. 16, 1912; pupation, Jan. 22; emergence, 9 a.m., Feb. 4. The 3 *P. aurivillii kasaiensis* sent were running over the larva of 603 B.

Seven mature Jassids, *Nehela ornata*, and 10 immature forms of the same species are labelled as the food-insects of 603. One mature *Nehela*, together with the nymph-case from which it emerged about Jan. 17, is also present. All from the forest near Oni Clearing, about Jan. 17.

"Jan. 18, 1912. In the course of a further search for Lycaenid larvae I have obtained two of the same species which are carnivorous and prey on active jumping Homoptera, which they lull to a false sense of security by simulating the attentions of ants. The history of my discovery is as follows. On Jan. 14 I found, on a young leaf of the plant *Musanga smithii*, R.Br. (*Urticaceae*), a small Lycaenid larva brown in colour and studded all over with tubercles. A number of the small black ants, since determined as *Pheidole aurivillii* r. *kasaiensis*, were running about over the leaf, on the underside and margins of which they had built up shelters of waste vegetable matter, such as they construct so frequently over *Stictococcus sjöstedti* and other Coccids.

"On cutting off the leaf with a view to making a closer examination, I shook it, with the result that several tiny insects, since described as the Jassid *Nehela ornata*, Dist. (see p. 519), left the shelters and jumped to a distance in all directions. I did not at the time attach any definite significance to the presence of these insects; but the larva would not feed in captivity. I offered it a fresh branch of the plant on which it had been, and when it refused this I tried it with maimed ants, *Aphidae*, *Stictococci*, and the larvae of *Membracidae*, for I could not find any more of the Jassids near which it had been discovered. On Jan. 16, however, I came across another cluster of ant-tended Jassids of the same species on the stem of a different plant, and at rest close to them was a similar larva over which the ants were running. I then felt that the association must be more than accidental, so I cut the stem through and transferred it to a glass tube. Most of the Homoptera managed to evade capture by jumping off, but I secured three which soon gathered together again on the stem. By the evening the ants were ministering to them and caressing them with their antennae, and, as I watched, the larva crawled slowly in the direction of the insects, stopping frequently and vibrating all three pairs of true legs. It stopped when it had nearly reached the Jassids, and then again moved on with, I believe, only the first pair of legs in vibration. It then reached the insects and caused its vibrating legs to play on the closed wings of a Jassid, in such a way as to simulate, as I thought, the caresses of ants.

"Still advancing, it gradually raised the fore-part of its body so as to overhang the insect and, when well above,

suddenly dropped and seized its prey with all its true legs.

"The larva immediately bit in behind the head, holding the insect pressed down on the stem, and when it had taken several mouthfuls, it raised the fore-part of its body and continued feeding, now holding the Jassid well away from the stem. The victim was by this time incapable of movement, and as the larva had no difficulty in retaining it by means of its second and third pair of legs, the first pair was used to take up loose fragments, and guide them to the mouth. I saw a loose leg thus taken up and eaten, and in this way every particle of the unfortunate little 'hopper' was secured.

"After the meal the legs of the first pair were drawn one after the other between the mandibles, and then polished on the outer side of the face, after the manner of a cat.

"I continued to watch the larva closely. It remained without movement for about twenty minutes and then approached another Jassid. This one was evidently not satisfied as to the honesty of its purpose, for immediately the larva commenced to tickle it, the Jassid ran away up the stem to a distance of about half an inch. However, the larva followed on and overtook it, and in due course it shared the fate of its predecessor, the series of actions by the larva being precisely the same as described in the former case.

"I was up early next morning on the hunt for more of the food-insects, and the larva first found made up for its long fast by catching nine out of eleven between 8 a.m. and 3 p.m.

"The procedure was so interesting to me that I actually witnessed the caressing, capture, and eating of most of these, and I have seen it many times since. The caterpillars eat both nymphs and imagos of the Jassids, but seem to secure more of the former, for though these are able to jump and run with surprising activity, quite as fast as an ordinary ant, the imagos sometimes escape by flying. When imagos are eaten, the hard anterior wings are usually rejected. The perfect and imperfect forms are certainly of the same species; for I have seen, and now send, a partially emerged imago. The Jassids of all stages congregate on young shoots of a variety of plants, and are frequently covered by 'shelters' built by ants.

"I have considerable difficulty in obtaining a sufficient

quantity of food-insects for the larvae and find it necessary to enclose them, stem and all, in a wide-mouthed jar containing chloroform vapour, and then, when they are overcome, I can transfer them to the tube containing the caterpillars.

"In nature the slow-moving Lycaenid larva must depend for its very existence on the fact that these insects are gregarious and if disturbed frequently re-assemble at the same spot.

"The egg-masses of these Jassids are attached to plants in clusters, much like those of the Membracids, *Leptocentrus altifrons*, Walk. (p. 496), viz. in parallel rows often superimposed so as to form oval masses; the Lycaenid larva does not interfere with these.

"The ants in attendance on the Jassids frequently run over these caterpillars and stroke them with their antennae, but are not so attentive as they are to other Lycaenid larvae. I do not think that the ants obtain any secretions from the caterpillars, and I have not made out the existence of either dorsal gland or tubercles."

A further note from a letter dated Jan. 20, 1912, is as follows:—

"If the caterpillar is on a broad surface it raises itself anteriorly when grasping a victim, but when on a narrow surface it drags the insect off its support by simply bending to one or other side."

A note dated Jan. 22, 1912, runs thus:—

"I went out collecting again to-day and filled my tubes with so much material that, when I found the Jassids required as food for my larvae, I was obliged to drop the 6 obtained into a tube containing a stem bearing *Stictococci* with their attendant ants, *C. buchneri alligatorix*. When I reached home I found that these ants had attacked 2 of the Jassids and were running about with them in their jaws. I rescued them, but they were so badly injured that they soon died. One of the carnivorous larvae pupated late in the afternoon of Jan. 20, and the other is now in the resting condition, which is a relief, for I have had difficulty in obtaining enough of the food-insects, and, though I found other Jassids very closely allied, the larva refused them." The collection contains 6 of the above-mentioned *alligatorix* with confirmatory data.

More of the same species are referred to in the following notes written on Jan. 29, 1912.

"No. 621 A—D. I have now 3 more pupae and 1 larva which are, I feel almost sure, *Megalopalpus*, and the interesting point about them is that they would not take the Jassid *Nehela ornata* which was eaten by my 2 previous larvae.

"Larva 621 A was found in the forest near Oni, on Jan. 22, 1912, in an ant-shelter on *Triumfetta cordifolia*, Guill. and Perr. There were no Jassids at all in this shelter, but it covered a large number of little green hopping creatures which look to me like immature Membracids. [Seven Membracid larvae of various sizes with 45 ♀ min. and 2 ♀ maj. *Pheidole aurivillii kasaiensis*.]

[From this point as far as p. 468 many observations on the relationship between ants and *Membracidae* are recorded. These pages should be read in connexion with Section D, pp. 494–8.]

"I placed the larva in a tube with some of the Jassids [4 *Nehela ornata*], but it had eaten none by the following morning, Jan. 23. I thereupon introduced the top of a *Triumfetta*, bearing shelters containing ants [*Pheidole rotundata*, var., 11 ♀ min., 1 ♀ maj.], and little Membracid larvae. The ants swarmed out and seized the Jassids and they ran all over the larva, one seizing it by an anal clasper exposed as it stretched across between two leaves. The larva did not feed but suspended itself for pupation and on Jan. 24 house-ants of the same species, *P. rotundata*, var. [26 ♀ min., 1 ♀ maj.] came in but did not seem to want to molest it though they ran all over it." The larva subsequently died.

"The second larva, 621 B, was found in the forest near Oni, on Jan. 23 in a shelter on *Triumfetta* containing the ants, *Pheidole aurivillii kasaiensis* [21 ♀] and Membracid larvae [13 of various stages]. I saw this Lycaenid larva feeding on a large larva of the Membracid type though I did not actually witness the attack. The caterpillar ate the body and then part of the head, but was unable to finish its meal, for a tiny ant, which had been dragging persistently at the remaining morsel, managed to get it away.

"On Jan. 24 I admitted the small black house-ants, *P. rotundata*, and I am under the impression that their attitude to the caterpillar was distinctly hostile.

"The larva duly pupated and on pulling away the leaves of the *Triumfetta* so as to break down the ant-shelter I

found on the stem a tiny white Lepidopterous egg-shell, which I have since learnt to be that of *Megalopalpus*." The pupa died.

Membracid larvae similar to those mentioned under 621 B have been bred out and the species has been determined by Mr. W. L. Distant as *Gargara variegata*, Sign. Four examples bred from the earlier stages are in the collection sent, one of them accompanied by the nymph-case from which it emerged.

The account continues :—

"621 C. ♀. The larva of the butterfly C was also found in a similar ant-shelter. I have mislaid my precise notes about it, but I know that one of these larvae—this particular one I believe—was attacked by house-ants, *P. rotundata* [5 ♀ min., 1 ♀ maj.], one of which fastened on to one of its legs, so that I had to remove it." The 6 *Pheidole* are accompanied by the note "621 C. House-ants found in box with larva, 24. i. 1912."

The labels on 621 C give the following information :—

Larva, forest 1 mile E., Jan. 23; pupation, Jan. 27; emergence about 9 a.m., Feb. 2.

"Another larva, 621 D, was also found on Jan. 25, on breaking into a shelter constructed like the others, on *Triumfetta*, by *P. aurivillii kasaiensis*. [Twenty-nine ants of this species from the shelter are in the collection, together with 23 immature Membracids of various stages and 2 imagines of very different species. One resembles *Anchon relatum*, but is in very poor condition, while the other is a very small species perhaps of the genus *Gargara*.] These shelters so efficiently conceal their contents that on breaking this one open four days later I found a second half-grown *Megalopalpus* larva inside, the presence of which I had not suspected.

"I put a new shelter containing *Pheidole rotundata*, var. [17 ♀ dated Jan. 29] and Membracid larvae into the tube. An ant immediately seized the *Megalopalpus* larva ventrally just behind the mandibles. This larva was not successfully reared.

"I should have mentioned that a fully developed Membracid, attended by ants, was feeding near the shelter in which 621 D was found, and another similarly near the shelter of 621 A and 621 B." [These specimens were not sent, and probably escaped.]

This note concludes the observations recorded Jan. 29.

An ant-shelter on *Triumfetta* often contains, in addition to immature forms of *Gargara*, young *Membracidae* of several other species. The precise determination of these has not been possible, for they have not yet been bred out, but, judging by their general characteristics, they probably belong to the genera *Anchon* and *Beninia*. One frequently finds Membracid imagines of the genera *Anchon*, *Beninia* or *Gargara* feeding in the open on a stem close to an ant-shelter and tended by ants from it, and though these shelters are usually constructed by a species of *Pheidole*, yet it is not uncommon to find them also built by the ants, *Camponotus akwapimensis*, var. *poultoni*, and containing the same Membracids. This latter ant was the only one taken in the following shelters, etc., found, unless otherwise described, on *Triumfetta* in the forest near Oni Clearing, Jan. 27, 1912 :—

Shelter E. Eighteen larval Membracids of various stages and at least 2 species, fragments of the shelter, 4 ants.

Shelter F. Twenty-five larval Membracids of various stages and at least 2 species, 7 ants.

Shelter G. Twenty-eight larval Membracids as above, 4 ants.

Shelter H. Twenty-two larval stages almost certainly of the Jassid *Nehela ornata*, 3 ants.

From another shelter near Oni Clearing, also examined Jan. 27, but not noted as on *Triumfetta*, 1 mature Membracid, probably *Beninia lamborni* (p. 517).

On Jan. 26, in the forest $\frac{1}{2}$ mile E., on *Triumfetta*, but not noted as from a shelter, 1 mature Membracid, evidently *Beninia*, sp., and probably *B. lamborni*, but in poor condition, with 1 ant.

On Feb. 26, on a stem in the forest $\frac{1}{2}$ mile E., 21 mature *Nehela ornata*, 2 larvae probably of the same species, 8 ants ♀ min., varying much in size.

A note dated Feb. 10, 1912, is as follows :—

“I have another pupa of *Megalopalpus* from a larva which ate a species of Membracid closely allied to *Gargara variegata*, although it refused this species.”

The chrysalis referred to cannot be that of No. 673, which did not pupate till Feb. 13.

“No. 673, Feb. 26, 1912. This *Megalopalpus* took a rather different Membracid from other Lycaenids I have reared. I have bred one of its food-insects from larva to imago, and am now sending it labelled ‘of especial

importance,' for I do not know where to get any more for identification."

The specimens sent under 673 are *Megalopalpus zymna* ♀; larva in the forest, $\frac{1}{2}$ mile E., Feb. 7; pupation, Feb. 13; emergence, Feb. 25: *Leptocentrus altifrons* and the nymph-case from which it emerged; larva in the forest, Feb. 17; emergence, Feb. 23. The *Leptocentrus* is labelled "food-insect of 673."

A note of Mar. 7, 1912, runs:—

"*Megalopalpus* usually deposits its egg in the immediate neighbourhood of a colony of the food-insects, but I have sometimes found an egg on the egg-mass of the insect. In one case it was on the eggs of the Membracid, *Leptocentrus altifrons*, Walk., but I could not find this again so as to watch the progress of the larva, and, though I am familiar with the immature forms of *Leptocentrus*, I have never seen the larva eat them. [The history of No. 673 shows that this last statement is mistaken: see above. E. B. P.]

"The egg of *Megalopalpus* is very characteristic, being a circular disc with a broad flattened white margin and a raised bluish semitransparent centre.

"On March 5 I found two nymphs in the same colony of the Membracids *Gargara variegata* unsheltered by ants and each bearing an egg of *Megalopalpus*: in one case on the right side of the dorsal surface of the abdomen just behind the wing, and in the other on the base of the left wing. ["Forest $1\frac{1}{2}$ miles E." on labels of the two specimens.]

"The larvae were on opposite sides of the stem and I did not examine them very closely at the time of capture for fear of losing them, but when I got home I found one eggshell empty though I did not see any larva."

Further notes on ants and the ova of *Lycaenidae*, etc., are as follows:—

"April 29, 1912. The eggs of some Lycaenids seem to be specially protected. I have seen a *Liptena lybissa*, Hew., deposit an egg on a dead stick, and a few days later I saw a Lycaenid unknown to me deposit two eggs right in the path of a procession of black ants running between the ground and their nest which was placed 20 feet up on a tree-trunk. The ants were all round her as she oviposited.

"I have several times watched *Megalopalpus zymna* deposit a single egg among ants which have subsequently investigated it with their antennae but have not interfered with it. The eggs of various species of other families,

however, are sometimes greedily taken by ants. A *Charaxes ussheri*, Butler, in my possession laid, on Mar. 17, 1912, 8 eggs, 6 of which were eaten in the night by the small black ants, *P. rotundata*, var."

"June 3, 1912. I am sending a white *Larinopoda* which I saw deposit an egg on a dead stick. There were no ants on it, but they were abundant on leaves of other plants in the neighbourhood.

"May 13, 1912. I saw to-day a number of the *Oecophylla* ants carrying off the larvae of the Saturnian moth *Bunaea alcinöe*, Stoll, as they hatched from the egg."

The following notes refer to the relationship between *Megalopalpus* butterflies, Homoptera and ants:—

"Dec. 29, 1911. I took an *M. zymna* ♀ on the same stem with a Membracid, *L. altifrons*, and 4 attendant ants, *P. aurivillii kasaiensis* [3 are in the collection], all being so sluggish that I readily secured them between the bottle and cork of a killing bottle. The butterfly was probing with its proboscis under and around the Membracid, and I am quite sure that the proboscis occasionally touched the insect's body." ["Forest $\frac{1}{2}$ mile E." on specimens.]

"Jan. 10, 1912. I took two *Megalopalpus* ♂ ♀, which were probing with their tongues under and around a Membracid, *Anchon relatum*, Dist. [the type of the species, p. 516], near to which were 2 immature and 1 mature *Nehela ornata*. Seven ants, *P. aurivillii kasaiensis*, were in attendance." ["Forest 1 mile E." is on specimen, together with a note which apparently implies that the butterflies were probing the Jassids as well as the Membracid. E. B. P.]

"Jan. 15, 1912: Forest $\frac{1}{2}$ mile E. I obtained 2 *Megalopalpus* [1 ♂ only in collection] sucking food from the fore-wing of one or other of 2 Membracids, *Leptocentrus altifrons*, which were on a green stem, side by side and attended by 19 *P. aurivillii kasaiensis*."

"Jan. 21, 1912: Forest $\frac{1}{2}$ mile E. I took a ♂ *Megalopalpus* sucking food off the fore-wings of 3 Jassids, *Nehela ornata* [labelled as the food-insects of No. 603 A, B, p. 459]. Nine *P. aurivillii kasaiensis* were in attendance."

"Feb. 7, 1912: Forest $\frac{1}{2}$ mile E. I took, on a green stem, a ♀ *Megalopalpus* probing with its tongue and evidently sucking up food material from 3 Jassids, *Nehela ornata* [the type and paratypes of the species, p. 519], which were attended by 5 ants." [Of the 5 ants which now

accompany the specimens, 3 are *P. aurivillii kasaiensis* while 2 appear to be *P. rotundata*, var., although they bear the name of the former species as the determination. It is probable that there has been an error in the labelling since the specimens were received from Switzerland, and that the 5 ants sent by Mr. Lamborn and named by Prof. Forel were all *kasaiensis*.]

"Mar. 9, 1912: Forest $\frac{1}{2}$ mile E. I captured a ♂ *Megalopalpus* probing with its proboscis a larva of a Membracid, probably *Gargara variegata*, eaten by its own larva. Seventeen ants, *P. aurivillii kasaiensis*, were in attendance."

The sluggishness of *Megalopalpus zymna* when feeding is well shown by the behaviour recorded in Proc. Ent. Soc. 1913, p. xxii. The following note gives additional details:—

"June 3, 1912. On May 28, I saw a worn *Megalopalpus* feeding, $\frac{1}{2}$ mile E., on a fresh leafless shoot covered with sticky secretion which ants were also enjoying. On May 29 I saw the same specimen in the same position, so, with a view to identifying it subsequently, I trimmed its right hind-wing off square with a pair of scissors. When released, it flew into a shrub near by, but it had returned on the following morning and was again feeding. I saw it again on the twig on May 30 [and on May 31 as recorded on the label], and I took it in my fingers and put it in the killing-bottle in the early evening of June 1."

[The following observations upon Oriental *Lycaenidae* allied to the Ethiopian *Megalopalpus* have a very direct bearing upon the facts recorded in the present paper by Mr. Lamborn. E. B. P.]

Mr. J. C. W. Kershaw, F.L.S., in an account of the life-history of *Gerydus chinensis*, Felder (Trans. Ent. Soc. 1905, pp. 1-4, Pl. I.), states that the butterfly lays its eggs towards evening, alighting "in the midst of the Aphides and ants, which she thrusts aside with a brushing movement of her tail, immediately laying a single egg. She then generally moves slightly and remains for some time sucking up the exuding juice of the plant; . . . The ants do not appear to meddle either with the butterflies or the eggs, though ants are very destructive to eggs of most butterflies, . . . Nor do they seem to interfere with the larvae." Mr. Kershaw describes the larvae feeding "on the Aphides, sometimes pressing them against the plant with head and fore-legs, sometimes holding them in the

fore-legs quite away from the plant. A few bites disposes of an Aphis and the larva then licks and cleans its legs, just as a Mantis does." Mr. Kershaw found that the larvae, after having eaten one kind of Aphis, were quite ready to take others of a different kind, in this respect differing from Mr. Lamborn's *Megalopalpus*. Furthermore, Mr. Kershaw has not observed *Gerydus* in the perfect state feeding upon the secretions of the Aphis or exploring them with its proboscis. With these slight exceptions the procedure of *Gerydus*, as described by Mr. Kershaw, and *Megalopalpus* seems to be nearly the same and points to a close affinity between these Oriental and Ethiopian forms.

The late Col. C. T. Bingham in the "Fauna of British India—Butterflies," vol. ii, 1907, pp. 287–288, describes and figures an observation by Col. H. J. W. Barrow, who states that *Allotinus horsfieldi*, Moore, "settles over a mass of Aphides and then tickles them with its proboscis, just as ants do with their antennae, and seems to feed on their exudations." The figure represents the butterfly clasping an Aphid between its two anterior legs. Barrow states that the butterfly was not attacked by ants. *Allotinus* belongs to the *Gerydinae* and is the genus next to *Gerydus*, the Oriental representative of the Ethiopian *Megalopalpus*. The observation was made at Maymyo, near Mandalay. Col. Barrow's account has been confirmed, except as regards the position of the anterior legs, by Mr. J. C. Moulton, Curator of the Sarawak Museum, Kuching, who showed the figure in Col. Bingham's book to his Dyak collectors and has thus been able to record similar observations (Proc. Ent. Soc. 1910, pp. xxxviii–xli) upon *Allotinus nivalis*, H. H. Druce, and an allied species. Moulton's Dyak collector also observed *A. horsfieldi* attending "Heteropterous larvae?" but the group to which the latter have been assigned requires confirmation.

A letter recently received from Mr. J. C. Moulton states that the same relationship between Lycaenids and Aphides was observed by the late Mr. R. Shelford in Borneo and also twice by the writer himself. Finally, in the same letter, Mr. Moulton records a recent observation still nearer to those of Mr. Lamborn in that the Homoptera were *Membracidae* :—

"I watched some few months ago a group of ants, a Lycaenid belonging to the sub-fam. *Gerydinae*, and

Homoptera (identified by Distant as the Membracid, *Ebhul varius*, Walker, previously only known from the unique Burmese type). The Membracids were quite passive while ants vigorously massaged them and imbibed the exuding liquid. The *Gerydus* rested within a foot of an ant, slowly stroking an Homopteron with his proboscis and I suppose at the same time drawing up liquid."

Mr. Moulton's letter was hurriedly written and is undated, but it is evident that the observation was made in the neighbourhood of Kuching in the course of the present year, 1913. E. B. P.

8. *Lachnocnema bibulus*, F.

The associated ant was *Camponotus akwapimensis* v. *poultoni*.

In this case, as in *Megalopalpus*, I have not discovered that the larva is of any direct benefit to the ants; for no glandular apparatus was found on it; but although it is protected by coarse hairs the ants certainly treat it with more consideration than they show to *Megalopalpus*, and in one case I gained the impression that they were endeavouring to feed it in spite of its habit of preying on their Homopterous protégés. The notes are as follows:—

"No. 692 A: Feb. 26, 1912. Forest near Oni. I found yesterday a new Lepidopterous larva, much like that of *Megalopalpus*, on a tree, on which were a number of tiny Homopterous larvae attended by ants. [The Homoptera have since been described as Jassids, *Ossana bicolor*, Dist. (p. 519), and the ants as *C. akwapimensis*, var. *poultoni*.]

"I have not yet seen this larva eat any of the insects, but I have observed it passing its mouth to and fro over them as if it might be obtaining food, and I have frequently seen the ants feed it with material obtained from the insect larvae. An ant and a larva stand in front of each other mouth to mouth. Some jerky movements take place, the ant stroking the larva with its antennae after the manner of an *Oecophylla* ant which, having stored itself with water, proceeds to dispense it to its fellows."

"No. 692 A, ♂: Mar. 7, 1912. This butterfly was bred from the larva which I thought was fed by ants. I have since speculated as to whether I might not have been mistaken in thinking that the ants feed the larvae.

Perhaps the position is reversed, and it is the larva that provides the ants with food, possibly buccal secretion or regurgitated material, since it has no dorsal gland. When I first had the larva it did not feed, as far as I could see, for 24 hours unless the ants gave it food, but it then ate a number of the Jassids. I imagine that these carnivorous larvae when they find a colony of food-insects have to make as big a meal as they can so as to be prepared against a possibly long wait before they find others.

No. 692 B, ♀. The larva was found in the forest $\frac{1}{2}$ mile E., on Mar. 3, and pupated on Mar. 7, 1912. "It ate the same food-insect as larva A, and they were attended by the same ants."

No. 692 C, ♀. The larva was found in the forest $\frac{1}{2}$ mile E., on Mar. 7, and pupated on Mar. 11. "It ate the same Jassids as larva A, and the same ants were in attendance on them."

Pupation of A, Mar. 1; B, Mar. 7; C, Mar. 11; emergence of A, 7 a.m., Mar. 10; B, Mar. 16; C, Mar. 20.

The Jassids, *O. bicolor*, were in each case found on similar food-plants, as yet undetermined. Nine mature and 17 immature Jassids in various stages were sent, together with 11 ♀ minor and 2 ♂ major *C. akwapimensis* v. *poultoni*—both Jassids and ants collected in the forest near Oni Clearing, Mar. 7, 1912. One ♂ major is the type of the variety. Five of the larval Jassids are different from the others and may perhaps be *Nehela ornata*.

9. *Deudorix* (*Hypokopelates*) *obscura*, Bethune-Baker,
sp. n. (p. 501).

The associated ant was *Cremastogaster buchneri* r. *alligatrix*.

No. 796. The larvae of the 2 male butterflies under this number were soft-bodied vegetable feeders. The note, May 26, 1912, runs: "The larvae of these 2 *Lycaenids* were found in the forest $1\frac{1}{2}$ miles E., on May 4, 1912. They were attended by a large number of ants, but I did not discover the source of attraction to them, for, as far as I could see, neither gland nor tubercles were present.

"The butterflies were new to me but may have been confused with others." Fourteen ants were in attendance.

Pupation, May 9; emergence, May 16.

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10. *Myrina silenus*, F.

The associated ants are probably *Camponotus maculatus* and *C. akwapimensis* v. *poultoni*.

A note bearing on the relationship between the larvae and ants was communicated on my behalf by Prof. Poulton in 1911 (Proc. Ent. Soc., pp. xcix-c). The ants in attendance seem to have been mostly the larger species, e. g. *Camponotus maculatus*, F., ? subsp., and *C. akwapimensis* v. *poultoni*, but little work has been done on these larvae since that time.

No. 696, ♀, the only specimen bred since 1911, was attended in the larval state by ants, but these have been lost. They were, however, I feel sure, *C. akwapimensis* v. *poultoni*.

The larva was found in Oni Clearing Mar. 1, 1912, pupated Mar. 4, and the butterfly emerged Mar. 14.

11. *Myrina subornata*, Lathy.

The associated ant, only in the house, was *Pheidole rotundata*, var.

No. 694. The note referring to this ♀ specimen is extracted from a letter dated Mar. 24, 1912:—

“The larva of this Lycaenid resembled very closely that of *Myrina silenus*. It was found Mar. 1, 1½ miles E. of Oni camp, on a small tree in the centre of a native village—a position unfavourable to the presence of ants, and there were none in attendance. The larva, however, had both dorsal gland and tubercles, and the small black house-ants (*Pheidole rotundata*, var.) found their way to it very soon after I brought it home. The tubercles were exerted on tactile stimulation. The pupa also was like that of *Myrina silenus*, and the small black ants covered it completely with débris, though it was suspended in a vertical position. The larva did not feed while in my possession.” It was found on the food-plant of the Bombycid moth *Norasuma kolga*, Druce, and on the under-surface of the leaves were numerous colonies of the Coccids, *Dactylopius longispinus*, Targ.-Tozz., which, as already reported in the Proc. Ent. Soc., 1912, p. xviii, are eaten by the larva of the Lycaenid, *Spalgis lemolea*, H. H. Druce.

The larva of this *Myrina* bore a close resemblance to that of *M. silenus* and was, moreover, found on a species of fig-tree to which family the food-plant of *M. silenus* is

to be referred, so that I have no doubt that it also is a plant-eater. Pupation occurred Mar. 5 and emergence Mar. 14.

12. *Hypolycaena nigra*, Bethune-Baker, sp. n. (p. 502).

The associated ant was *Pheidole aurivillii* r. *kasaiensis*.

No. 653, A—I. The ♂ type of the species is G, the ♀ type D. The note referring to these 9 butterflies (8 ♀, 1 ♂) is as follows:—

“Feb. 26, 1912. The larvae were all found in the forest, 1½ miles E., on two adjacent leaves, on Feb. 4. I am sure they are all of one company.” The larvae were soft, green, and onisciform in shape. Of the numerous attendant ants, *P. aurivillii kasaiensis*, 16 were sent.

All the larvae pupated Feb. 5; A—E emerged 8 a.m. and flew about 9.30 a.m., Feb. 13; F and G (the only male), about 8.30 a.m. and flew 10 a.m., Feb. 13; H, 7 a.m., and I, before 7 a.m., Feb. 14.

13. *Hypolycaena (Zeltus) lebona*, Hew.

The associated ant was *Pheidole aurivillii* r. *kasaiensis*.

No. 595. A note of Jan. 18, 1912, refers to a female specimen:—

“I am sending a Lycaenid butterfly, with the 8 precise ants which were in attendance on its larva. I was able to see the dorsal gland in this, but was not sure as to the presence of the tubercles. The larva eats the cortex of the young shoots, and rarely the upper or lower surface of the leaves of the wild ‘bush-yam’ called ‘Ewo’ in the Yoruba tongue.”

The 8 ants in attendance were *P. aurivillii kasaiensis*.

The larva was found in the forest 1 mile E., Jan. 4; pupation, Jan. 7; emergence, 7 a.m., Jan. 16.

No. 627. My note referring to a male specimen is as follows:—

“Jan. 29, 1912. The larva of this Lycaenid was deep green in colour. The orifice of the dorsal gland was conspicuous, having reddish lips: at the usual site of the tubercles were white spots, but I did not see the structures protruded.”

Four *P. aurivillii* r. *kasaiensis*, in attendance, were sent with the imago. The larva was found Jan. 12, in the forest, 1½ miles E.; pupation, Jan. 16; emergence, about 10 a.m.; flight, 11.45 a.m., Jan. 27.

14. *Hypolycaena philippus*, F.

The associated ants were *Pheidole aurivillii kasaiensis* (probably), *Ph. rotundata*, var. (in the house as well as in the open), *Camponotus akwapimensis* v. *poultoni*, and *C. maculatus*, the latter as an exception.

A note bearing on the relationship between these larvae and ants was communicated on my behalf to this Society by Prof. Poulton on Dec. 6, 1911 (Proceedings, pp. c-ci). The ants therein mentioned as being in attendance on the larvae when found are now recognised, after a study of Prof. Forel's recent determinations, as a species of *Pheidole*, very probably *aurivillii* r. *kasaiensis*, whereas the "house ants" which came and attended the larvae in captivity were certainly *Pheidole rotundata*, var. The following butterflies were bred during 1912 :—

No. 643, a female specimen, was reared from a larva found on Jan. 31, 1912, in forest $\frac{1}{2}$ mile E., and 3 *C. akwapimensis* v. *poultoni* were in attendance on it. The larva was then transferred to another plant in Oni Clearing near my house, and, on Feb. 4, six *P. rotundata*, var., were removed from it.

Pupation, Feb. 5; emergence, about 9 a.m., Feb. 12.

No. 675, a male specimen, was bred from a larva found in Oni Clearing on Feb. 14, 1912 : 3 *P. rotundata*, var., were in attendance.

Pupation, Feb. 16; emergence, Feb. 25.

A third larva, which died Jan. 16, was found Jan. 12 in Oni Clearing with a single *Camponotus maculatus*, F., subsp.?, in attendance. This ant is in my experience an unusual attendant of *H. philippus*.

15. *Argiolaus alcibiades*, Kirby.

The associated ant was a race of *Cremastogaster buchneri*.

No. 805. A letter dated June 10, 1912, states that the pupa of this ♀ Lycaenid was found June 2, in the forest $1\frac{1}{2}$ miles E., on a leaf of *Culcasia scandens*, Beauv. (*Aroideae*), a plant of ivy-like habit, climbing up a Kola tree on which was a huge nest of black ants which were scattered everywhere on the plants. The ants were undoubtedly a race of *Cremastogaster buchneri*.

Emergence, June 6.

16. *Argiolaus julus*, Hew.

The associated ant was a race of *Cremastogaster buchneri*.

No. 765 A—C. Two males and 1 female. The note in my letter, dated May 13, 1912, is as follows :—

“The larvae of these *Lycanidae* were ant-attended and had each a dorsal gland, though I could not see any tubercles. The three were found together in the forest $1\frac{1}{2}$ miles E., on a climbing parasitic plant. They were wonderfully coloured, ruby and green being predominant.”

Unfortunately the precise ants in attendance were not collected, but they were undoubtedly a race of *C. buchneri*. The larvae were plant-eaters.

All pupated Apr. 23 and emerged May 3.

17. *Spalgis lemolea*, H. H. Druce (*S.-signata*, Holl.).

The Coccid food of the larva has been recorded in the Proceedings of this Society (1911, pp. civ–cv; 1912, p. xviii). Additional notes on these larvae and their food-insects are reproduced below :—

“Jan. 7, 1912. I had repeatedly examined the Coccids without detecting the larvae, and it was only my attempt to find a particularly large Coccid for examination that led me to turn one over and discover it to be Lepidopterous.”

“Feb. 18, 1912. The larvae of *Spalgis lemolea* do not strike me as being much larger than the Coccids on which they feed, for they are rather flattened and usually nestle up closely to the masses of Coccids under what appears to be a common covering of shed cuticles, etc. It is sometimes really quite difficult to distinguish them. The Coccids are so closely packed and so well covered that one can rarely see the form of a single individual.”

“June 15, 1912. I have watched several *Spalgis* ovipositing on the Coccid masses, and am now sending some larvae in spirit. It is quite common to see tiny Coccids wandering in the material on the back of the larvae.”

Some of the Coccids, as eaten by the larvae of *Spalgis*, from the plant “Pride of Barbados” in Oni Clearing, May 25, 1912, were sent in spirit, and these, when examined by Prof. Newstead, F.R.S., were found to be *Dactylopius virgatus*, var. *madagascariensis*, Newst. (p. 523). The food-insects previously sent were determined by the same authority as *D. longispinus*, Targ.-Tozz. (Proceedings, 1912, p. xviii); hence the larvae of *Spalgis lemolea* are not confined to a single species of Coccid. Although the condition of the specimens was such that Prof. Newstead

cannot be certain about either determination, he is nevertheless quite sure that the species are different.

18. *Lycaenesthes* sp.? *alberta*, Bethune-Baker.

The associated ant was *Cremastogaster buchneri* r. *clariventris*.

The specimens are stunted so that their determination was difficult. Mr. Bethune-Baker, however, after comparing them with the type of *alberta*, considers that they probably belong to the same species.

The following note refers to three bred specimens, 1 ♂ 2 ♀:—

No. 705. Mar. 24, 1912. "The larvae of these *Lycaenidae* were all obtained at Idakun on one plant on March 13. A dorsal gland and tubercles were present in the usual situation and a great number of ants, rather different from any others I have sent, were in attendance."

The ants, which numbered 31, have been determined as *C. buchneri*, Forel, r. *clariventris*, Mayr.

All three pupated Mar. 15 and emerged Mar. 23.

19. *Lycaenesthes liodes*, Hew.

This species has a green, onisciform, leaf-eating larva. Notes as to a bred specimen are as follows:—

No. 719, male, April 1, 1912. "This larva had both dorsal gland and tubercles in the usual region. Three ants were in attendance on it when found." These were despatched home but were lost, probably in the post. The imago and its pupa-case arrived safely.

Larva in forest, 1½ miles E., Mar. 20; pupation, Mar. 23; emergence, Mar. 30.

20. *Lycaenesthes silvanus*, Drury.

The associated ants were *Pheidole aurivillii* r. *kasaiensis* (probably) and *Camponotus akwapimensis* v. *poultoni*.

A preliminary note as to the relationship between the larvae of this species and ants was communicated to this Society by Prof. Poulton in 1911 (Proceedings, p. civ).

The larvae are green and onisciform, and are leaf-eaters.

No. 553, A, B. Two males. Dec. 4, 1911. "The larva was found on a leaf with ants in attendance."

Ten *P. aurivillii kasaiensis* are probably the specimens referred to, but decisive data are wanting.

The above note refers to a single specimen, but the lettering probably indicates that the 2 larvae were found together.

A, Larva in forest, 1 mile E., Nov. 23, 1911; pupation, Nov. 26; emergence, about 3 p.m. Dec. 3. B, Larva in forest, 1 mile E.; emergence, about 3 p.m. Dec. 6. No other data.

No. 616, male. Jan. 18, 1912. "The larva was found in the forest, $1\frac{1}{2}$ miles E., on Jan. 11, with two ants in attendance. It had both dorsal gland and tubercles, the former hard to see owing to the absence of any special pigmentation."

The two ants were *C. akwapimensis* v. *poultoni*.

Pupation, Jan. 15; emergence, Jan. 22.

21. *Lycaenesthes larydas*, Cram.

The associated ants were *Camponotus akwapimensis* v. *poultoni* and *Pheidole aurivillii* r. *kasaiensis*.

A note on the relationship between these larvae and ants was communicated on my behalf by Prof. Poulton to this Society in 1911 (Proceedings, p. civ).

The larvae of this species were green and onisciform in shape and ate leaves. The notes referring to a long series are as follows:—

No. 611. *L. larydas* ♂. "Jan. 18, 1912. The larva of this Lycaenid, found in the forest near Oni Clearing on Jan. 10, possessed both gland and tubercles, which were sometimes protruded when I tickled it." It ate the food-plant of the Pierine *Terias senegalensis*, Boisd., and 3 ants in attendance on it were *C. akwapimensis* v. *poultoni*.

Pupation, Jan. 13; emergence, about 2 p.m., Jan. 21.

No. 613. *L. larydas*, ♀, tending to *kersteni*, Gerst. "The larva was found $\frac{1}{2}$ mile east of our camp on Jan. 8, 1912, and two ants were in attendance." These also were *C. akwapimensis* v. *poultoni*.

Pupation, Jan. 13; emergence, Jan. 21.

No. 614. *L. larydas*, ♀, tending to *kersteni*. "Jan. 18, 1912. The larva possessed a dorsal gland, but the orifice was hard to see, not being marked out by pigment. Two white tubercles were present and were protruded on tickling with a wisp of cotton wool." Larva in the forest near Oni Camp; imago emerged Jan. 22. No other data.

No. 617. *L. larydas*, ♂. "The larva was found on Jan. 8, 1912, in forest $\frac{1}{2}$ mile E. of Camp. There was only

one ant in attendance on it, a large ♀ min. of *C. akwapimensis* v. *poultoni*."

Pupation, Jan. 13; emergence, Jan. 22.

No. 623. *L. larydas*, ♂. Jan. 29, 1912. "I found the orifice of the dorsal gland in the larva of this specimen and detected the sites of the tubercles, but I could not cause them to be protruded."

One *C. akwapimensis* v. *poultoni* was in attendance on the larva, Jan. 14.

Larva in forest near Oni Clearing, Jan. 14; pupation, Jan. 19; emergence, Jan. 26.

No. 628. *L. larydas*, ♀, deformed.

"The larva was found $\frac{1}{2}$ mile east of camp on Jan. 15, 1912." One *C. akwapimensis* v. *poultoni* was in attendance.

Pupation, Jan. 17; emergence, Jan. 28.

No. 639. *L. larydas*, ♂, tending to *kersteni*.

The larva was found in the forest $\frac{1}{2}$ mile E., on Jan. 26, 1912, and 9 ants, *P. aurivillii kasaiensis* were in attendance on it. A note dated Feb. 5, 1912, records that both dorsal gland and tubercles existed in the larva.

Pupation, Jan. 29; emergence, before 9 a.m., Feb. 5.

No. 641. *L. larydas*, ♂, tending slightly to *kersteni*.

The larva was found in the forest, $1\frac{1}{2}$ miles E., on Jan. 26, 1912, and 4 ants, *P. aurivillii kasaiensis*, were in attendance on it. A note dated Feb. 5 is as follows: "I saw the dorsal gland in the case of this larva, and tubercles were put out when I tickled it."

Pupation, Jan. 29; emergence, before 10 a.m., Feb. 5.

No. 669. *L. larydas*, ♀, tending to *kersteni*.

The larva of the specimen was found in the forest, $\frac{1}{2}$ mile E., on Feb. 13, 1912. One ant only, a *C. akwapimensis* v. *poultoni*, was in attendance.

Emergence, Feb. 22.

22. *Lycaenesthes lachares*, Hew.

The associated ants were *Pheidole aurivillii* r. *kasaiensis* and *Ph. rotundata*, var., the latter in the house as well as in the open.

[The females of *lachares* from the neighbourhood of Oni differ from the ordinary form of this sex in the absence or slight development of the yellow patch in the centre of the upper surface of each wing. Hewitson's type in the British Museum, from the Cameroons, has the patch strongly developed in each fore-wing, weakly in each hind.

Mr. W. A. Lamborn has sent 10 females captured on the following dates: 1910, March 26—two, April 5—one, May 24—one; 1911, Jan. 1—six. These last 6 were taken in one spot, and had evidently only just emerged from the pupa. The only specimen with the yellow patches conspicuous is that taken April 5, 1910. In all the others they are wanting, or very slightly developed. All these specimens are shown on Plate XXVI, figs. 1–10.

The relative development of the yellow marks in the females of the following series of bred specimens has been described as carefully as possible in order that comparison may be made with the above-mentioned captured females, and it will be found that this feature is, upon the whole, far more prominent in the former. The comparison suggests that artificial conditions, acting as a shock, have tended to cause reversion to the normal pattern of the species. The extent to which these yellow marks appeared, differed greatly in the females of the different groups, each of which was bred from larvae found together and therefore developed from the eggs of a single female. This difference is probably to be accounted for by differing hereditary tendencies towards reversion, so that, although the shock has probably been of the same general kind, the effects produced are far from uniform.

The whole of the bred females except No. 612, arranged in their little families, are represented on Plate XXVI, figs. 11–30.

Modification of the under surface, probably in consequence of artificial conditions, is also represented on figs. 31–39 of the same Plate. Figs. 31–36 represent the males and 37–38 the females of a single family (No. 615, p. 481), while fig. 39 represents the underside of a captured female for comparison with the two latter. It will be noted that the pattern of fig. 36 is extraordinarily different from that of the other males, although fig. 35 is slightly transitional towards it. Furthermore, the two females, especially that shown in fig. 38, have undergone somewhat similar modifications. It will be noticed that by far the greatest change, as shown in figs. 36 and 38, has been undergone by the smallest individuals, namely, by those which have presumably been most strongly affected by the artificial conditions.

The upper surface of the male shown in fig. 36 is also remarkable in the possession of a distinct pale submarginal

line, increasing in brightness and breadth towards the anal angle of both wings, but stronger in the hind-wing. The very peculiar pattern of the under surface is also visible through the slightly transparent wings and gives to the insect a peculiar and characteristic appearance. The upper surface of the male represented in fig. 35 is transitional towards that above described. E. B. P.]

The larvae were of the usual green onisciform type. The following note, referring to specimens numbered 605, 607, 609, 615, was written on Jan. 18, 1912 :—

“I am sending a long series of these *Lycaenids* grouped for the sake of precision under several numbers. The larvae of all, except those labelled 604, came off one shrub near Oni Clearing, on and about Jan. 10, 1912. The two, labelled 604, were taken, Jan. 11, $\frac{1}{2}$ mile E. of camp. These larvae were always found under leaves and in groups which I have kept distinct, and all were ant-attended. They showed a tendency to conceal themselves by drawing leaves together, especially when about to pupate. The eight larvae the imagos of which are numbered 615 were found together and six of them pupated under a leaf lightly attached to the wall of the box. House-ants replaced in most cases the usual attendant ants. I have mislaid a note on the position of the dorsal gland but it is present in the usual situation, and the paired tubercles were extruded on weak tactile stimulation.

“The larvae were all leaf-green, but became reddish, and exhibited oblique stripes of a lighter shade about 36 hours before pupation. All the imagos emerged about 8 to 9 a.m.—*never* earlier—and all flew about 10–10.30 a.m.” [605 C, D and 607 J appear to have been exceptions.]

The history of these 4 separate groups is as follows :—

No. 605. Six larvae found together under one leaf were attended by 18 ants, *P. aurivillii kasaiensis*, and 1 male and 5 female butterflies were bred from them.

No. 607. Five larvae, under one leaf, attended by 18 *P. aurivillii kasaiensis*, gave 2 male and 3 female butterflies.

No. 609. Two larvae under one leaf, which were attended by 7 *P. aurivillii kasaiensis*, gave 1 male and 1 female butterfly.

No. 615. Eight larvae under one leaf were attended by no less than 41 *P. aurivillii kasaiensis*. Six male and 2 female butterflies were bred from these.

The dates of pupation and emergence, etc., of the above-mentioned groups 605 to 615, found on a single shrub on or about Jan. 10, 1912, are shown below in tabular form :—

Group No. and date of capture.	Date of Pupation.	Date and hour of Emergence.	Sex, Reference Letter, and Fig. on Plate XXVI.	Development of wings of female.
605. Larvae found Jan. 10.	Jan. 12	Jan. 20 : about 10.0 a.m.	C ♀ Fig. 26	Yellow marks distinct in all four wings, and strong in all except D.
	" 12	" 21 : " 10.0 a.m.	D ♀ " 27	
	" 13	" 21 : " 8.0 a.m.	E ♀ " 28	
	" 13	" 21 : " 8.0 a.m.	F ♀ " 29	
	" 13	" 21 : " 8.0 a.m.	G ♀ " 30	
	" 13	" 22 : " 8.0 a.m.	H ♂	
607. Jan. 10.	Jan. 13	Jan. 21 : 8.30 a.m.	I ♀ Fig. 16	Distinct but not strong in I and K, very feeble in J.
	" 13	" 21 : flew 9.0 a.m.	J ♀ " 17	
	" 13	" 21 : 8.30 a.m.	K ♀ " 18	
	" 13	" 21 : flew 10.0 a.m.	L ♂	
	" 13	" 22 : 8.0 a.m.	M ♂	
609. Jan. 10.	Jan. 12	Jan. 21 : about 8.0 a.m.	N ♀ Fig. 24	Strongly developed.
	" 13	" 22 " 8.0-9.0 a.m.	O ♂	
615. About Jan. 10.	Jan. 12	Jan. 21 : 8.0 a.m.	P ♀ Figs. 11 and 37	Only faintest trace of marks on all wings of P and U. The ♂ W an extraordinary var., especially on under surface (p. 479).
	" 13	" 22 : about 8.0-9.0 a.m.	Q ♂ Fig. 31	
	" 13	" 22 : " 8.0-9.0 a.m.	R ♂ " 32	
	" 13	" 22 : " 8.0-9.0 a.m.	S ♂ " 33	
	" 13	" 22 : " 8.0-9.0 a.m.	T ♂ " 34	
	" 13	" 22 : " 8.0-9.0 a.m.	U ♀ Figs. 12 and 38	
	Unrecorded	" 23 : " 8.0 a.m.	V ♂ Fig. 35	
	"	" 23 : " 8.0 a.m.	W ♂ " 36	

Other bred specimens are :—

No. 604. Two *L. lachares*, both females (Plate XXVI, figs. 19, 20). Although number 604 is earlier than those of the groups already described, the larvae were captured later and are therefore treated in this position. The two larvae were found under one leaf, in the forest $\frac{1}{2}$ mile E., Jan. 11, 1912 : pupation, Jan. 13; emergence of ♀ A, 9 a.m., Jan. 20, of ♀ B, 8 a.m., Jan. 21.

Three *P. aurivillii kasaiensis* were in attendance on the larvae.

The yellow marks are well developed on the wings of both females, but not quite so strongly as on those of 605.

No. 612. *L. lachares*, ♀. "Jan. 18, 1912. This larva had a dorsal gland rather more conspicuous than in most, because the anterior and posterior lips were pink in the mid-line and white on each side. Tubercles of the usual kind were present." Larva, near Clearing, Jan. 10; pupation, Jan. 12; emergence 8 a.m., Jan. 21.

Yellow marks well developed—as in 605 C.

No. 631. One *L. lachares*, ♀ (Plate XXVI, fig. 14). The larva was found on Jan. 20th, in forest 1 mile E. Six *P. rotundata* are accompanied by the note "631. Ants in attendance on larva when found." Pupation, Jan. 22; emergence, about 10 a.m., Jan. 31. Distinct trace of yellow marks on fore-wings, extremely faint on hind.

No. 632. Two *L. lachares*, 1 male and 1 female (Plate XXVI, fig. 13). The larvae of these were found together on Jan. 20, in the forest, $\frac{1}{2}$ mile E. No ants were sent home with the specimens, so that it is doubtful as to whether the larvae were ant-attended when discovered, but as soon as they were placed in a box the house-ants, *P. rotundata*, to the number of nine, 8 ♀ min. and 1 ♀ maj., came and attended them.

Both pupated Jan. 24 and emerged Feb. 2.

Faintest trace of yellow on all wings of female—even less than on 615 P and U.

No. 637. One *L. lachares*, male. The larva was found in forest, $\frac{1}{2}$ mile E., Jan. 24, 1912, with three *P. aurivillii kasaiensis* in attendance on it. A note dated Feb. 5 runs as follows: "The larva of this Lycaenid was green. The orifice of the dorsal gland was indicated by two bright pink spots, one in the middle of each lip. I did not succeed in getting the larva to put out its tubercles, but there were dark patches in the region where these are usually found."

Pupation, Jan. 30; emergence, before 9 a.m., Feb. 5.

Nos. 665, 666 and 667, all *L. lachares*, were bred from larvae found on one plant 1 mile E. on Feb. 9, 1912.

No. 665. A female (Plate XXVI, fig. 25) was bred from a larva found on a leaf by itself with 2 *P. aurivillii kasaiensis* in attendance.

Pupation, Feb. 12; emergence, about 8 a.m., Feb. 20. The yellow patches are strongly marked.

No. 666. Two males and 3 females (Plate XXVI, figs. 21-23) were bred from larvae on one leaf attended by *P. rotundata*, var., which were removed. House-ants of the same species subsequently covered the pupae with débris, traces of which may be seen on 2 out of the 3 pupae in the collection. Eleven *P. rotundata*, var., are accompanied by the note "ants in attendance on 5 larvae, Feb. 9, 1912." It is worthy of note that the other ants taken from the same bush were *P. aurivillii kasaiensis*.

All pupated Feb. 12 and emerged Feb. 20,—1 male at 8 a.m., the remaining butterflies at about this hour. The females were strongly yellow-marked on fore-wing, rather less so on hind-wing.

No. 667. A female (Plate XXVI, fig. 15) was bred from a larva with 6 *P. aurivillii kasaiensis* in attendance.

Pupation, Feb. 12; emergence, about 8 a.m., Feb. 20. The wings, especially the fore-wings, are slightly but distinctly yellow-marked.

23. *Lycaenesthes flavomaculata*, Smith and Kirby.

The associated ants were *Odontomachus haematodes* and *Cremastogaster buchneri*, races *winkleri* and *alligatrix*. Also, in the house, *Pheidole rotundata*, var.

No. 602, A—C, 2 males and 1 female were bred from 3 larvae found side by side under a leaf in the forest, $\frac{1}{2}$ mile E., on Jan. 9, 1912. A note dated Jan. 18, thus refers to them: "The precise ants, 18 *C. buchneri winkleri*, in attendance on the larvae are sent. I was able to see with the unaided eye the orifice of the dorsal gland in the usual situation. In the case of one larva a droplet of watery fluid exuded from it. I could not detect any special taste to it, but I subsequently watched the house-ants, *P. rotundata*, var., which adopted the larvae, drinking it. I could see no tubercles, though a light spot on each side in the usual situation suggested that they might be present. The larvae dropped to the ground when I started ant-catching."

All pupated Jan. 11. ♀ A emerged 10 a.m., ♂ B about 10.30 a.m., Jan. 19; ♂ C 9 a.m., and flew 10 a.m., Jan. 20.

No. 638. A male butterfly was bred from a larva found in the forest near Oni Clearing, Jan. 24, 1912.

"Feb. 5, 1912. The larva had a dorsal gland, but the

orifice was not indicated by special pigmentation. No tubercles were extruded when I tickled the larva, but on one occasion only a drop of fluid—tasteless to me—exuded from the orifice of the gland.” One ant, *Odontomachus haematodes*, L., was in attendance on the larva. I have not before noted the association of any ant of this genus with Lycaenids.

Emergence before 10 a.m., Feb. 5.

No. 640. A male butterfly was bred from a larva found in the forest near Oni Clearing, on Jan. 28, 1912. Ten ants were in attendance [identified by Prof. Forel as *C. buchneri alligatrix*. Mr. W. C. Crawley and Mr. A. H. Hamm, after a careful examination, are convinced that one out of the ten is a typical example of the race *winkleri*]. On the evening of Jan. 28, three *P. rotundata*, var., were taken off the larva in the house. The following note, dated Feb. 5, refers to this larva :—

“The dorsal gland was seen, but no tubercles. I watched house-ants on the larva with a hand-lens, and actually saw one drink up fluid from the gland.”

Emergence, Feb. 5.

No. 651. A female specimen was bred from a larva found in the forest $\frac{1}{2}$ mile E., on Jan. 27, 1912. Seven ants were in attendance. [Of these 3 bear Prof. Forel's determination *C. buchneri alligatrix* and 4 his determination *C. buchneri winkleri*. All bear the number “651.” Mr. W. C. Crawley and Mr. A. H. Hamm, after examining these specimens and comparing them with Prof. Forel's descriptions, conclude that the 4 labelled *winkleri* are, although intermediate, nearer to *alligatrix*.]

Pupation, Jan. 31; emergence, Feb. 8.

24. *Neurypexina lyzanius*, Hew.

The associated ant was *Pheidole rotundata*, var.

No. 579, A—F. Two male and 4 female butterflies. The note dated Jan. 8, 1912, refers to these as follows :—

“The larvae of these 6 Lycaenids were found in the forest $\frac{1}{2}$ mile E., Dec. 28, 1911. They were all close together on the new shoots of a broken stem, but they were non-gregarious. They were attended by *P. rotundata*, var., but I was obliged to collect all the attendant ants in one box, so that it will not be possible to arrange particular groups with their original Lycaenids.” Twenty-one *P. rotundata* were labelled “in attendance,” 18 “on other

parts of the same plant," while 12 others cannot be placed with certainty in either category.

Pupation, ♂ B, Dec. 31; 1 ♂ 4 ♀, Jan. 1. Emergence, ♀ A, Jan. 8; 2 ♂ 3 ♀, Jan. 9. ♂ B and ♀ C emerged about 9 a.m.

No. 600. A male butterfly was bred from a larva found in the forest $\frac{1}{2}$ mile E., on Jan. 5, 1912. No less than 37 *P. rotundata*, var., were on the same leaf, many concentrating their attention on the larva.

Pupation, Jan. 10; emergence about 2 p.m., Jan. 18. A note records that the larva was the same as 579 A—F.

25. *Triclema lucretilis*, Hew.

The female of this species is described by Mr. Bethune-Baker on p. 503. The associated ants were *Cremastogaster buchneri*, races *alligatrix* and *winkleri*. Also, in the house, *P. rotundata*, var.

No. 555. A single male specimen. A note dated Nov. 27, 1911, runs :—

"I recently found 4 remarkable Lycaenid larvae, though 3 have since died and the remaining 1 is sickly. I first saw a little dark green larva in a pit which it had gnawed in the dark green cortex of a soft plant. It was small, and I removed it carefully for the purpose of an examination with a lens. There were numerous ants on it (*C. buchneri alligatrix* *). Having examined it, I replaced it on the stem and it soon crawled down and vanished into a hole out of which ants had been coming. I found 2 other small larvae on the stem, and a fourth could be seen just inside another hole.

"I opened up a stem, and in so doing, cut into a larva inside it. The ants, which bite and so produce a little temporary skin irritation, came rushing out in numbers."

Larva in forest $1\frac{1}{2}$ miles E., Nov. 22; pupation, Nov. 27; emergence, 8 a.m., Dec. 7. This male butterfly is somewhat dwarfed, and the blue markings on the upper surface are much reduced. The pale markings on the under surface are yellow.

A further note referring to the same ants on Jan. 10, 1912, runs thus : "These particular ants bite savagely, and when

* The 7 ants sent as examples of those attending 555 were collected at a later date, viz. Jan. 10, 1912.

alarmed run about with abdomen uplifted and turned forwards over the thorax."

The note of Nov. 27 continues: "I found that the pith in the centre of the stem had largely been eaten away and that on the inner side were a number of little pits. In some of the older tunnels thus produced were white scale insects. Normal stems have no central cavity."

I feel confident that the larvae of *Triclema* eat only the young cortex of this particular plant, and that the presence of Coccids is accidental as far as they are concerned, although there probably is relationship between the Coccids and the ants.

No. 657. Five male and 3 female butterflies. One of these latter is the specimen described by Mr. Bethune-Baker (p. 503). A note in my letter of Feb. 26, 1912, records that no less than 12 pupae were found in the forest $\frac{1}{2}$ mile E., on about Feb. 13, in the central cavity of a stem similar to that already mentioned. Three of the pupae were injured in opening it up and one other pupa died. Ants, undoubtedly one of the races of *C. buchneri*, were running in and out of holes in the stem as in the preceding case. The stem was suspended in a box in my bungalow, and, on Feb. 14, twenty-three "house-ants," *P. rotundata*, var., were collected off the pupae.

One male emerged about 7.30 a.m., Feb. 14, the remaining butterflies about 8 a.m., and probably on the same date. Four ants bear the note "ants in cavity of stem with the 12 pupae. Feb. 13, 1912." [Owing to some error these examples were not sent to Prof. Forel, but Mr. W. C. Crawley and Mr. A. H. Hamm are confident that they are *C. buchneri winkleri*.]

No. 660. Two female butterflies. Three pupae were found in the forest near Oni, in a similar hollowed stem about Feb. 13, but one died. The precise ants in attendance on them have been mislaid, but they were undoubtedly a race of *C. buchneri*.

One butterfly emerged about 9 a.m. Feb. 15, the other about 8 a.m. Feb. 16.

[Both specimens, as well as No. 663 (p. 487), are somewhat dwarfed, and their upper surface is of a uniform fuscous tint with barely a trace of the markings of the normal females as described by Mr. Bethune-Baker (p. 503). The under-surface markings are much yellower than in any of Mr. Lamborn's 5 normal females, in this respect resembling

males 555 and 662. In order to confirm the sex, Mr. Eltringham kindly mounted and examined a fore-foot of the specimen which emerged Feb. 16. E. B. P.]

No. 662. This male specimen was bred from a larva found in the forest $1\frac{1}{2}$ miles E. on Feb. 4, 1912, which pupated Feb. 6, and emerged Feb. 16. The ants running in and out of the cavity were *C. buchneri* r. *winkleri*, of which 11 were sent.* The following note, dated Feb. 26, refers to the specimen :—

“ This Lycaenid was walled up in the stem when in the pupal state by débris brought by house-ants, *P. rotundata*, var. These butterflies when freshly emerged seem to me to possess an excessive amount of downy material about the coxae and ventral surface of the body which frequently gets rubbed off and deposited on the edges of the opening by which they leave the stem.”

[F. P. Dodd, in “ Entomologist,” 1902, p. 184, speaks of the thick covering of loose scales by which the freshly emerged *Liphyra brassolis*, Westw., is protected from the attacks of *Oecophylla* ants.]

The hollow stem which contained the pupa still retains plenty of the débris brought by the house-ants.

No. 663. A female specimen was bred from a larva found in the forest $1\frac{1}{2}$ miles E., Feb. 2, 1912, on a similar stem. It was attended by a race of *C. buchneri*.

Pupation, Feb. 7; emergence, Feb. 16. This specimen is dwarfed, dark, and yellow-marked beneath like females 660 (p. 486).

No. 670. Two female butterflies were bred from larvae found on a similar stem in the same locality, Feb. 14, 1912. They entered the central cavity on Feb. 15, and consequently I lost sight of them. Ants were as usual in attendance, but though none were sent home they were without doubt a race of *C. buchneri*.

One butterfly emerged Feb. 22, the other was flying 8 a.m.; the date unrecorded, but probably Feb. 22.

The association of the particular ants *C. buchneri* with the larvae in nature is perhaps to be explained by the fact that these ants favour the particular tree, which provides food for the larvae, as a site for their carton nests.

* Four ants only were determined by Prof. Forel, but Mr. Crawley and Mr. Hamm have no doubt that the whole series belongs to the race *winkleri*.

26. *Cupido (Catochrysops) malathana*, Boisd.

The associated ant was *Camponotus akwapimensis* v. *poultoni*. Also, in the house, *Pheidole rotundata*, var.

No. 581. ♂. The following note refers to the larva of the specimen :—

“Jan. 7-8, 1912. On Jan. 5 I discovered a small Lycaenid larva which had eaten an oval hole in the side of a seed-pod and was half inside and half out of it. The seed-pod belonged to a Leguminous climbing plant with a flower very like that of our French bean.

“Five ♀ min. and 1 ♂ maj. *C. akwapimensis poultoni* were running to and fro on the pod, the centre of interest being the larva. On the dorsal aspect of the visible half of its body was a small dull-red area over which an ant was standing head down and holding his ground all the time against the attempts of others to come there. I secured all these ants and they are now sent. On arriving home I discovered a drop of fluid rather larger than a pin's head on this patch. I shut the larva up closely and left it for the night. On the same day I had found two *Oboronia* pupae in a head of the plant *Costus afer*, and had left them on my verandah table. I found next morning that the small black ‘house-ants,’ *P. rotundata*, var., had made an attempt to cover them with bits of wool, excreta of caterpillars and tiny fragments of wood, so I took away the pupae, and the ants scattered over the table. I then opened the box containing the *Catochrysops* larva which had left the seed-pod, and the ants very soon swarmed over it. I removed all the ants save three so that I was then able to watch the proceedings without difficulty.

“The ants undoubtedly obtained food-material from the red patch, but behind and to its outer side I observed, on either side, a little white tubercle which was protruded and drawn in again repeatedly, and with such great rapidity that one could hardly count its movements. I then took away two more ants. The remaining one fed at the red patch, and now that the other ants were no longer running over the larva the two tubercles remained protruded. Presently the ant made a rush at one of the tubercles which was promptly withdrawn. It then ran over to the second tubercle. This was withdrawn in turn, but the first tubercle was thrust out again and incited the ant to rush back a fraction of a second too late to secure anything, for

the tubercle had been already retracted. This happened repeatedly, and I then took away the ant and examined the structures more closely.

"The larva, green in colour and onisciform in shape, is about 7 mm. in length. The red patch, which is about 2 mm. long and 1 mm. broad, is situated in the mid-dorsal line of segments 10 and 11. It is diamond-shaped and the anterior angle is produced forwards and constitutes the area on segment 10. I feel sure that with a lens I can see a crescentic opening, with the concavity directed backwards, in the portion of the patch on segment 11.

"Both tubercles are on segment 12, 3 mm. behind and to the outer side of the patch, and 4 mm. from the mid-dorsal line, and their length when fully extended is, according to my estimate, 1 mm. The tubercle is white, and, with a lens, one can see a ring of tiny bristles forming a fringe encircling its blunt and rounded apex. When the ants are removed, the tubercles are only to be seen for about half a minute, and when they are retracted one cannot detect the exact spot at which they were extruded, but a weak tactile stimulus will cause one or other to reappear.

"The larva subsequently entered the little seed-pod again and ate out the whole of the interior, voiding a large quantity of pale green excreta. It spent the whole of yesterday crawling about without taking food, and to-day (Jan. 8) it has become motionless and is almost concealed under débris piled up by the ants (*P. rotundata*). If this happens under natural conditions the covering must effectually conceal the pupae."

The following data accompany No. 581. Larva in forest $1\frac{1}{2}$ miles E. Jan, 5, 1912; pupation, Jan. 9; emergence, 10.45 a.m., Jan. 16; flew about 11.45 a.m. Of the 6 *C. akwapimensis poultoni* attending larva Jan. 5, one is a ♀ major, and 3 of the minors are much larger than the other 2. Eight of the *P. rotundata*, var., attending the larva from Jan. 6 were also sent, together with the material heaped by them over the resting larva on Jan. 8; also the seed-pod and the pupa-case.

27. *Cupido (Oboronia) punctata*, Dew.

The associated ants were *Pheidole aurivillii kasaiensis* and *P. rotundata*, var., the latter in the open as well as in the house.

Various notes on the habits of the larva were communicated for me by Prof. Poulton to this Society in 1911 (Proceedings, pp. ci-civ). The ants which construct a nest over the head of the plant *Costus afer*, Ker.-Gawl. (*Scitamineae*), in the calyces of which the larva lives, have since been determined as belonging to the genus *Pheidole*, and two species are probably concerned, viz. *P. aurivillii kasaiensis* and *P. rotundata*, the former being more usually found.

No. 442. The 15 butterflies of this series were all bred from larvae and pupae found in the calyces of *Costus afer* between Sept. 11 and Oct. 7, 1911. All were covered in by nests built up by *Pheidole*. The larvae and pupae were found in Oni Clearing and in the forest at various points up to $1\frac{1}{2}$ miles E., the majority coming from this latter distance. Specimens D, E, F, G, J, O and P (all males) bear notes stating that they emerged at 9 a.m., and an eighth unlettered ♂ specimen "about 9 a.m." Only 2 specimens, B, ♀, and G were captured as larvae, on Sept. 10 and 13 respectively: they pupated Sept. 11 and 15 and emerged Sept. 21 and 26. Of the remainder A, C, and K are ♂, I, L, and N ♀. Nearly all the pupa-cases are contained in the calyces of the food-plant—never more than one in each. The remainder are attached to the scale-like leaves of the flower-head.

No. 474. The female parent, referred to in Proceedings, 1911, p. cii, was captured in a swamp in Oni Clearing, Sept. 18, 1911. She died and was partially eaten by ants Sept. 21. The 3 probable offspring, all ♂, emerged Oct. 2, 6, and 7 respectively. The larvae and pupae were tended by house-ants, *P. rotundata*. The conditions of the breeding experiment, as described in the Proceedings, leave little doubt that these 3 butterflies are the offspring of 474 and therefore that the cycle from egg to imago is run through very rapidly.

No. 580, A ♀ and B ♂. Two pupae were found in Oni Clearing on Jan. 4, 1912, in the usual situation on *Costus afer*, and 50 *P. aurivillii kasaiensis* were collected from the ants' nest. On Jan. 6 the pupae were covered in the house with material brought by *Pheidole rotundata*, 20 of which, 19 ♀ min. and 1 ♀ maj., were collected.

Emergence of A, Jan. 6; of B, 9 a.m. Jan. 9.

No. 582, ♀. One pupa was found Jan. 3, 1912, in Oni Clearing in a calyx of *Costus afer* covered by a nest of

P. aurivillii kasaiensis; the imago emerged Jan. 7: 31 ♀ min. and 1 ♀ maj. were collected from the nest.

"Jan. 15, 1912. The small black house-ants, *P. rotundata*, var., covered up the pupa as it lay on my table with particles of wood, wool and other rubbish, including the egg-shells of a Saturnian moth and the shed caudal horn of a Sphinx larva."

"Jan. 15, 1912. With a view to attracting more ants I left a lump of sugar on the table and an attempt to cover this also was made. These ants liked the sugar very much, but they are also carnivorous and had devoured a small green Mantis which I had left on the table dead.

"I found a small box containing tiny red house-ants and their larvae which I placed on a table where the small black house-ants (*P. rotundata*, var.) come. The latter soon vanquished the former and carried them off with their larvae."

No. 596, ♀. The larva was found on Jan. 2, 1912, in Oni Clearing in a head of *Costus afer*. The butterfly emerged on Jan. 15, about 7 a.m.; 7 ♀ min. and 2 ♀ maj. of *Pheidole rotundata* were collected Jan. 2, from the nest covering the head of the plant.

No. 597, ♂. The pupa was found in Oni Clearing in a head of *Costus afer* on Jan. 14, 1912, and the imago emerged on Jan. 15 about 7 a.m.; 13 *P. aurivillii kasaiensis* were collected Jan. 14 from the nest covering the head of plant.

C.—CARNIVOROUS MOTH-LARVAE AND MOTH-LARVAE ASSOCIATED WITH ANTS.

1. *Eublemma ochrochroa*, Hampson (*Erastrinae*).

These little Noctuid moths were compared in the British Museum with the type of the species, from Sierra Leone.

No. 776. The larva of this moth was found near Oni Clearing on Mar. 29, 1912, and a note dated May 13 thus refers to it:—

"The larva was very remarkable. I discovered a stem of *Triumfetta cordifolia* bearing Coccids, *Stictococcus sjöstedti*, on the secretions of which *Oecophylla* ants were feeding. Among the Coccids was a small brown oval structure, apparently of silk, fixed to the bark. I took it to be a cocoon and so brought it home, but by and by the structure moved with considerable rapidity, and I then

saw that it consisted of a case concealing a purple caterpillar. This covering was not an intrinsic part of the larva, for I believe that the latter was able to turn round almost completely beneath it. I certainly saw its head very near where the anal extremity had been and from time to time at the side. The larva ate one Coccid and then became quiescent, having sealed down its covering to the stem on all sides. The cocoon-like structure sent is really the covering of the active larva. Though I was able to see very little of it I felt certain that this larva was *Lycaenid*; for I have found other larvae which I am sure were *Lycaenidae* under coverings of débris. Accordingly when a little moth emerged I did not connect it with the cocoon until two days later, when I noticed for the first time the valve-like aperture by which it had made its exit."

Pupation about Mar. 31, emergence Apr. 10. A *Stictococcus* is still attached to the stick bearing the cocoon.

No. 826. The larva of this moth was found near Oni Clearing on May 22, 1912, and is referred to in the following note :—

"July 1. The larva of this moth was carnivorous and was found moving among *Oecophylla* ants and feeding on Coccids, *Stictococcus sjöstedti*, the food of the larva of *Aslauga lamborni*. The ants were feeding on the secretions of the Coccids. The larva was protected by a rounded covering of silk in which were the remains of *Stictococci*, and this covering served to form the cocoon."

Pupation about May 26, emergence June 24. A *Stictococcus* is also attached to the stick bearing the cocoon, and remains of *Stictococci* are clearly visible in the walls of the latter.

2. Probably *Euproctis* sp. (*Lymantridae*).

No. 844. The larva of this little *Lymantrid* moth was found near ants, June 24, 1912, in the forest 1½ E. It spun June 26, and the perfect insect emerged July 8. The moth itself bears a remarkable superficial resemblance to a *Lithosid* of the genus *Mitochrista*.

3. *Obtusipalpalis saltusalis*, Schaus (*Schoenobiinae*).

The larvae and pupae of this *Pyrilid* moth live in the flower-heads of *Costus afer* among the *Pheidole* ants which tend the larvae and pupae of the *Lycaenid*, *Oboronia punctata* (see pp. 489–91, also Proceedings, 1911, pp. ciii, civ).

No. 484 A and B. The pupa of A was found Oct. 7, 1911, in an ants' nest in a head of *Costus afer* in Oni Clearing. The moth emerged Oct. 10. The larva of B was found, Sept. 27, 1911, in a similar situation in the forest $1\frac{1}{2}$ E. The moth appeared Oct. 10.

4. *Tinthia lambornella*, Durrant, sp. n. (p. 513) (*Egeriidae*).

No. 674. The following note refers to the single bred specimen.

"Feb. 26, 1912. The larva of this Aegeriid moth was maggot-like, and lived inside a stem which I cut open in my search for *Lycaenidae*. These particular stems are often hollowed out by a large ant (*Sima aethiops*, Smith ♀) which lives inside in company with some scale insects, samples of which are sent in spirit. The ants often form communities of 6 or 7 [probably workers with a ♀] in an internode and have larvae with them."

The moth larva was found by itself in an internode, but ants were found in those on either side of it. The moth is accompanied by its pupa-case in a hollow stem, together with 9 ♀ *Sima*, bearing the date Feb. 29, and 2 stems similar to those which they inhabit. A note states that the ants were found each in a separate internode, at Alo, 4 miles E. of Oni. [The date of the above note (Feb. 26) shows that the moth larva was not taken with these particular ants.]

5. *Tortrix callopista*, Durrant, sp. n. (p. 513).

No. 625. The larva of this moth was found in the forest $1\frac{1}{2}$ miles E., on Jan. 14. My note concerning it is as follows :—

"Jan. 15, 1912. On going yesterday to obtain more Coccids as food for *Lycaenid* larvae, I discovered, on the stem of the same plant, some inanimate objects which looked very like *Lycaenid* larvae. In the walls of each were imbedded a number of *Stictococci*. On attempting to remove one with scissors I found that it was hollow and contained a maggot-like *Lepidopterous* larva, and that the wall covering the larva was composed of silk with brown material containing the Coccids on its outer side."

"Jan. 29, 1912. This tiny moth was bred, Jan. 27, from a larva, similar to one sent in spirit, which I found in a tunnel constructed under *Stictococci* which are eaten by the

larva of *Aslauga lamborni*. I have since found that the little moth larvae eat out the inside of the Coccids, attacking them from underneath, and when one is eaten they construct a tunnel so as lead to and get beneath another."

It is probable that the minute Lepidopterous larva which Prof. R. Newstead describes as preying upon *S. sjöstedti* is allied to *T. callopista* (see p. 522, also Journ. Econ. Biol., vol. v, 1910, p. 22).

D.—ANTS AND MEMBRACIDAE.

The following section deals with the relationship between ants and *Membracidae* and incidentally includes observations on the life-history of one species,—*L. altifrons*. This section should be read in connexion with that upon *Megalopalpus zymna* (p. 458) and especially pp. 463–468, where many other observations on *Membracidae* and their attendant ants are recorded.

1. *Leptocentrus altifrons*, Walker (see also p. 516).

No. 38. "These insects are fairly plentiful on the growing stem of the food-plant of *Acraea bonasia*, F.—*Triumfetta cordifolia*, Guill. and Perr., var. *hollandii*, Sprague (*Tiliaceae*), and I see them occasionally on that of *A. parrhasia*, F.—*Urera obovata*, Benth. (*Urticaceae*). They are invariably attended by ants. Sometimes they are found singly and sometimes there are several together. They are easily examined in situ, but hard to catch, as they jump off to an astonishing distance and take to flight with great suddenness."

The 14 specimens bearing No. 38 were found Oct. 14, 1911, in the forest $1\frac{1}{2}$ miles E. Accompanying them is an egg-mass on *Urera obovata*, with the same data.

Companies of mature forms are frequently found, but never as far as I remember on green stems, and I am disposed to think that these massed individuals are invariably such as have only just emerged from the nymph condition and that they scatter when hardened up. (See also Proc. Ent. Soc. 1913, pp. xxxvi–xxxvii, and xxxvii footnote.) One frequently finds mature forms feeding on green stems but rarely more than two together, and they are invariably ant-attended. Thus among the specimens sent is a single large *L. altifrons*, found Jan. 14, 1912, on a green stem in

the forest $\frac{1}{2}$ mile E., together with the 2 attendant ants, *C. akwapimensis* v. *poultoni*.

The solicitude of ants for the larvae has a very definite object, for they are extremely partial to the fluid excreted at the anal extremity, and I remember seeing a *C. akwapimensis* v. *poultoni* with the caudal whip of a Membracid larva actually in its mouth. [The same attraction is also described by J. C. Kershaw in Ann. Soc. Ent. Belg., Vol. LVII, 1913, p. 191.]

The attraction exercised on ants by mature forms is not so clear, but in some cases it has seemed to me that the ants have obtained edible material off the wings. The ants usually in attendance on this species are *C. akwapimensis* v. *poultoni*, but two mature specimens found near Oni Clearing about Jan. 6, 1912, were attended by *Pheidole rotundata*, var. These Membracids, No. 54, were found near a shelter containing larvae, probably of the same species, of which 7 were sent, accompanied by the 18 *P. rotundata*, var., which attended both larvae and imagines.

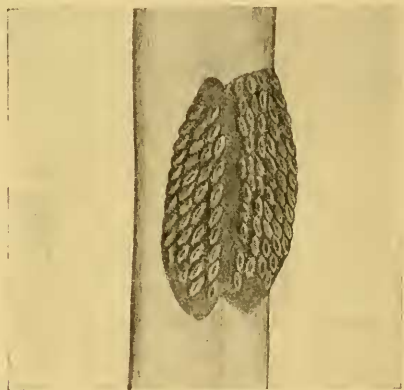
Oviposition. A note referring to a female specimen runs as follows :—

No. 43. "This insect was found ovipositing Oct. 25, 1911, on a stem of the plant, *Triumfetta cordifolia*, Guill. and Perr., var. *hollandii*, Sprague, $1\frac{1}{2}$ miles E. of Oni camp. She sat so closely over the egg-mass that I was able to cut off the twig and place it, without disturbing her, in my killing-bottle. Two ants were in attendance, and one seemed to obtain food-material from her wings." The specimen is much larger than Walker's type of *L. altifrons*, but this may be accounted for by the sex. The twig with the egg-mass (figured on p. 496) is in the collection but the ants were not sent.

Since writing the above, I have found a number of ovipositing females which always exhibited the same astonishing degree of reluctance to quit the egg-mass—so much so indeed that it is always possible to make a close examination with a lens, and, if one wishes to capture such a specimen, it is easily taken between thumb and forefinger, a method of capture which is impossible under ordinary conditions. Oviposition is a lengthy proceeding and lasts from 36 to 48 hours.

I believe, though I have to trust entirely to memory on this point, that the eggs are placed only on the old brown cortex and never on the green stem of any plant. The

length of time the female is engaged in oviposition and her apparent insensibility to any danger which may be threatening her must certainly necessitate the careful selection of a site on which she is least likely to be subject to attack, and though on a green stem *Leptocentrus* is a conspicuous object, on a brown stem her dark colour and her shape are, I am sure, of cryptic value, so that she is likely to be detected only by the practised eye. The egg-mass forms an oval structure about 10 mm. long and 8 mm. broad, and the eggs are arranged in parallel rows often superimposed. See the accompanying figure [which shows a condition very different from that described in two Membracids by J. C. Kershaw, *l. c.* pp. 191, 192].



Egg-mass of *Leptocentrus altifrons*: \times about $4\frac{1}{2}$.

Hatching and the earliest larval stages.—The following note describes the hatching of larvae which I am now confident are those of *L. altifrons*:—

No. 53. "On Jan. 2, 1912, I watched some Membracid larvae hatching. When first seen, the tiny larvae were just starting to come out of the 2 egg-masses side by side on a twig of *Triumfetta*. Two or 3 had left the eggs and were huddled together $\frac{1}{4}$ inch higher up the stem. No ants were present. When seen again on Jan. 4, hatching was still in progress and a mass of larvae had collected about an inch above the eggs. The uppermost larvae, viz. those first hatched, were at least double the size of the lowest, and, on the twig below the mass, tiny scattered larvae were crawling up to join the rest of the community.

Large black ants were in attendance. By taking my time I was able to snip off the leaves and secure both larvae and ants on the stem in a test-tube. The soft green bark bore numerous puncture marks at the spot where the larvae had been feeding. When disturbed, the larvae started to run in various directions quite actively. More have hatched out to-day (Jan. 6) and with a lens I can see that when alarmed, even these exude a tiny drop of fluid at the anal extremity, and then run away, frequently backwards."

The following material illustrates the above notes:—

Sixty-eight minute larvae, hatched Jan. 2-4, together with the double egg-mass on *Triumfetta*, another stem showing punctures and 10 attendant *C. akwapimensis* v. *poultoni*—all collected near Oni Clearing, Jan. 4-6, 1912.

Later stages.—The following note refers to a series of 10 larvae, or more probably nymphs, which I now know to be those of *L. altifrons*. They were taken in the forest, 1½ miles E., on Sept. 1, 1911, and are accompanied by 4 of the attendant ants—*C. akwapimensis* v. *poultoni*.

No. 19. "These insects—attended by a great number of ants—were all congregated at the end of a green stem. Perfect insects were present with them, but took the alarm and flew away directly I touched the stem. The larvae or nymphs now sent retreated slowly down the stem, crawling backwards and protruding a pink caudal whip at the end of which a drop of fluid, the size of a pin's head, appeared. If one attempted to catch them, they ran away with great speed or else jumped off suddenly in various directions. On examination of the stem on which they had been, one always found numerous puncture marks for the purpose of feeding."

2. *Neoxiphistes lagosensis*, Dist., gen. et sp. n. (see p. 515).

No. 50. A company of 9 mature forms of these Membracids were found all huddled together on old cortex on Dec. 8, 1911, attended by 9 *C. akwapimensis* v. *poultoni*. These have the same habit of springing away suddenly when disturbed, but my note records that in the early morning they are more sluggish than later in the day. I have never seen companies of this species on a green stem. These specimens, which belong to a new genus and species described by Mr. W. L. Distant on p. 515, were taken in the forest, about 1 mile E. of Oni Camp.

3. *Anchon decoratum*, Dist., sp. n. (p. 516).

No. 48. Two mature examples, the type at Oxford and the paratype in the British Museum, were found together in the forest, 1 mile E., Dec. 3, 1911. Two larvae of different sizes and probably of 2 different species were captured with them, as well as 34 attendant *P. aurivillii kasaiensis*. [The number of the ants suggests that more Membracid larvae or imagines were present, but escaped. E. B. P.]

E.—PSYLLIDAE, ANTS, AND DIPTERA.

1. *Rhinopsylla lamborni*, Newstead, sp. n. (see p. 520).

No. 61. "These insects, *Rhinopsylla lamborni*, are very numerous now. The larvae are found, on plants in the clearing, in large colonies hidden in a white woolly down which is rather sticky. When hunting through this for Lycaenid larvae, on Feb. 18, 1912, I came across some Dipterous larvae and 2 Dipterous pupae, the imagines from which emerged Feb. 24."

These 2 Diptera with their puparia have been submitted to Mr. E. E. Austen who informs me that the species is *Baccha claripennis*, Lw. (*Syrphidae*).

"On Feb. 25 I found numerous mature forms of the *Rhinopsylla*, and, in the 'wool,' other Dipterous pupae. The ant *Camponotus maculatus*, F., is occasionally found obtaining food in the 'wool.'"

Seven Diptera bred, Mar. 2-5, from the above-mentioned pupae, have been determined by Mr. Austen as *Baccha picta*, Wied., or a species very near to it. A single example of the Trypetid fly *Ceratitis punctata*, Wied., also bred Mar. 2-5, Mr. Austen thinks can only have been accidentally present as larva or pupa in the "wool." The carnivorous larvae of the 2 *Syrphidae*, on the other hand, were just where we might have expected to find them.

The collection also contains a "wool"-covered mass of nymphs and large numbers of imagines of *R. lamborni* collected Feb. 25-26. Two pairs were taken *in coitu*.